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# The Airpower HISTORIAN

A Missile Comes To Town On A Friendly Visit.
*A display of the Air Force THOR intermediate range ballistic missile and its supporting equipment at the Culver City plant of Douglas Aircraft Company.*

THE AIR FORCE HISTORICAL FOUNDATION

# The Airpower HISTORIAN

THE AIR FORCE HISTORICAL FOUNDATION

VOLUME VII • NUMBER 4 • OCTOBER, 1960



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CAPT. D. B. McBRIDE

# THE MILITARY IN AMERICAN LIFE

By CAPTAIN DONALD B. McBRIDE, USAF

*For the First time in United States peacetime history, the nation is maintaining a large military establishmen capable of military operations in any area of the world. This situation, a direct result of the apparent communist military threat to the United States, has placed a special emphasis on military factors in American foreign and domestic activities. Today the armed forces maintain hundreds of military installations in all parts of the United States; national defense requirements dominate the federal budget, and large numbers of military personnel are integral members of American society.*

*With the emergence of the military as a vital part of American life since World War II, the United States is undergoing drastic but little realized transformations in social and psychological attitudes toward its military establishments. While the increased economic importance of military expenditures is partly responsible for these changes, military activities today also affect American governmental, political, civic, cultural, and social attitudes, especially at the local level, where most military-civilian contacts occur. However, it appears that the effect and the extent of military influences in these areas of American life have received little serious study.*

*This paper reports the results of an empirical study of military influence on various aspects of community life where the military component has expanded to significant dimensions.*

## The Changed Status of the Military Since World War II

THROUGHOUT most of United States history, from the Revolutionary War to the end of the Second World War, military influences on American economic, social, and governmental activities were significant only during periods of external or internal hostilities. During the intervening years of peace, martial activities in the U. S. were largely confined to those few localities where the federal government maintained permanent army and navy installations. Seldom did military forces exert a dominant influence on the local affairs of the communities in which they were located, but tended to remain detached and remote, largely insulated from economic, civic, and political life of the surrounding area and undisturbed by either economic depressions or political campaigns.

Regular military personnel traditionally lived apart from the American civilian

community and society. Until World War II, relatively few professional military officers entered politics or business after their retirement. The specialized nature of the military profession, the distrust of the military by a large segment of the population, the frequent duty in remote or foreign posts, the transient nature of the military life, all tended to isolate the military professional from his civilian counterparts. Due to the nation's tradition of minimum armed forces, United States society did not develop a tradition of military service and, thus, social prestige was not usually accorded the military professional.

The official and social life of both officers and enlisted men revolved around their rank. Toward civilians there was intense military rank consciousness. During most of their careers, military personnel followed a quite uniform and prearranged pattern, subject to constant discipline and bureaucratic pressures which generally isolated and shaped them as intellectual products of a closed educational system.

This way of life led many writers to attribute the "military mind" to all military men. Writers have described this term in various ways. C. Wright Mills considers it to represent the product of specialized bureaucratic training and of common shared experiences and outlook of military life. To Dean Louis Smith it refers to military specialists who possess an inherent narrowness of concept in treatment of policy matters lying outside their limited spheres, or to military commanders who lack sensitivity in political matters and patience and finesse in dealing with subordinates or civilians.

As recently as 1958 an article in an official military journal pointed out that a high level of public esteem for professional military men was lacking in the United States. The article stated that this was due to the general civilian belief that they possessed military minds, in this case defined as the result of the alleged authoritarianism, standardization, inflexibility, lack of imagination, and resistance to change within the military circles.[1] Actually, there are as many different military minds as there are military personnel.

In spite of the isolation of the military from the main currents of American life and society, or because of it, fears and suspicions of military usurpation of civil powers appear to have remained germane to American liberal thought. This was undoubtedly due more to the basic antimilitarism of most Americans than to the reactions to any specific military personnel or activities. Since Washington was offered the "American crown" at the end of the Revolutionary War, which he scornfully rejected, there have been few, if any, indications of an American military intention or desire to seize political or governmental power in the United States. The concept of civil over military rule has generally been guarded as religiously by U. S. military leaders as by the nation's civilian leaders. Most military personnel have come from the conservative elements of American society and were reared in the democratic ideal. Generally, the senior officers of the military services have come from the upper middle class rather than from the higher or lower economic and cultural classes. They have usually been sons of professional men, or businessmen, of farmers or of military men. Thus their interests have tended to conform with those of the leading elements of American society.

The United States has never had to deal with a military caste or camarilla which has so often been a pressure group or political power in other countries. United States military groups traditionally have not exerted pressure of any significance. There have been and are in existence today organizations devoted to various phases of military activities or classes of military or retired personnel, but these have wielded relatively little political or economic power in the nation. The Grand Army of the Republic, the National Guard lobbies, the American Legion of the 1920's, have temporarily been effective pressure groups. Generals McClellan, Grant, and Butler of the Civil War period; Generals Leonard Wood,

William Mitchell, and Dwight D. Eisenhower of more recent history, have all exercised political power. But they were essentially military men acting as civilian politicians, not military politicians supported by the power of their armed forces. The political general has rarely been seen in American history.

Enlightened American statesmen have on occasion defended the nation's military forces against charges of militarism. Elihu Root, one of the U. S. Army's most influential Secretaries of War, challenged the Army's critics to point out a single act of disloyalty by the Regular Army to the concept of the supremacy of civil law over the military. In a testimonial to the professional military forces delivered in 1899, he stated that:

*No one ever knew of the American Army seeking to make itself a political agent. No one ever knew of the American Army seeking to make itself a Praetorian guard to set up a president or an emperor. No one ever knew of the American Army seeking to throw off . . . civil control of the military arm.*[2]

The prominence of U. S. military activities and leaders in World War II and in postwar national and international affairs constituted one of the most important developments of American history. During World War I, military personnel entered high U. S. economic and political circles only briefly, but in World War II they decisively intervened in these activities to insure effective war production and prosecution. During and after World War II the military bureaucracy became closely allied with and intertwined in the corporate economy of the country. Since military requirements continued heavy in the postwar period, many commercial firms soon realized the commercial value of retired senior officers. Many companies solicited the business services of these officers after their retirement. The United States had simultaneously become the world's leading industrial society and one of the world's leading military powers. This was paced with a nationwide military-business *rapprochement*. As one writer described it:

*Few developments more dramatically symbolize the new status of the military in the postwar decade than the close association which they developed with the business elite of American society. Prior to World War II, the professional officers and the capitalists in spirit and in fact had been poles apart. . . . After World War II, an abrupt change took place . . . . Professional officers and businessmen revealed a new mutual respect. Retired generals and admirals in unprecedented numbers moved into the executive staffs of American corporations; new organizations arose bridging the gaps between corporate management and military leadership. For the military officers, business represented the epitome of the American way of life. Association with business was positive proof and assurance that they had abandoned their outcast status and had become respected members of the American community. Financially and psychologically, the military men who moved from the officers corps to the corporation gained in security, acceptance, and well-being. The business firms, on the other hand, capitalized on the prestige of well-known commanders, the special skills and expertise of the officers in nonmilitary technical fields, their general administrative and organizing abilities, and their assistance in doing business with the Department of Defense.*[3]

The large numbers of military personnel who found post-retirement employment with business firms, including some of the nation's most famous war-time commanders, was indicative of the postwar impact of the military budget on the American corporate economy. To many people, of course, it appeared that these military men were so employed largely due to their contacts within and their knowledge of the military establishment. However, news reports indicate that most of them were valuable additions to corporate management. As the *Air Force Times*, a world-wide newspaper devoted

primarily to Air Force affairs, observed recently:

*The noted military leaders who have taken over big jobs in American industry make a real contribution to the companies paying their salaries. The general who traded his uniform and the $17,000 annual salary that went with it for a flannel suit and the $100,000 yearly, earns his new paycheck. These statements reflect the universal belief of the top minds in American industry. . . . The list of names of the men who today are sitting behind executive desks in industrial concerns reads like the "Who's Who" of our national military establishment since 1940. . . . Probably the best explanation of why industry has tapped so many former military leaders for high-paying peacetime positions was offered recently by [General] McAuliffe . . . . "A military commander gets a broad business background while carrying out his duties. He has to make decisions. He accepts responsibilities. He must have business judgment. He must have diplomatic ability and know how to get along with people of all nations." Now vice president for engineering and construction of the American Cyanamid Company, McAuliffe is a prime example of the industrial tycoon. . . . Another military man turned industrial leader is General James Doolittle. . . . When Doolittle left the military, his salary . . . was $17,000 a year. He was reportedly paid $100,000 last year by Shell Oil Company.*[4]

The continued importance of military affairs in postwar America was, of course, due to the realization of the uncompromising nature of international communism and the military threat of the communist world empire to the United States. This caused American public opinion after World War II to be dominated by the growing belief that the way to maintain even a precarious peace was by a strong American military establishment. Believing that the threat of superior force would restrain militant communism, the U. S. Government maintained relatively sizable occupation forces abroad and laid plans for a formidable string of strategic military bases around the periphery of the communist empire. United States armed forces were kept at approximately one and one-half million men in the years preceding the Korean conflict, while National Guard and Reserve forces were developed. In 1947, about one-third of the federal budget was required to support the peacetime military establishment as reorganized under the National Security Act of 1947. As recipient of such a large portion of the national budget in peacetime, the military exercised a significant influence within the nation.

The economic, political, and social influence of the military in the U. S. since World War II caused a decided reaction on the part of many civilian groups. Some liberals felt that the military was exercising an unprecedented influence on U. S. national affairs. There was concern over the alleged luring of scientists from civilian institutions to work exclusively for the military, the curbing of freedom of research, the military controls over industry, the expanding military lobbies in Washington which became among the most successful in the capitol.

Others felt that the centralization of government and military controls over the economy would lead to increasing military encroachments into other civilian fields. As one writer expressed it:

*With the power of the military extended to all phases of national life, its contrast and conflict with the civil authority has also become less apparent. In other words, military power is able to dominate civil authority to the point where the latter becomes a willing dupe of military men, overwhelmed by their prestige, and confused as to the validity of the experts' opinions and questions of larger policy. . . . With virtually the whole population enrolled in some military capacity or dependent upon the military office, all conflict with civil society is necessarily eliminated.*[5]

However, Samuel P. Huntington, in *The Soldier and the State*, took a different approach:

*Virtually all the criticism of the military influx was couched in terms of abstract constitutional and political principles and generalized dangers to civil government. With a few exceptions, it was impossible to demonstrate that the actions of any particular military officer reflected the inherently dangerous qualities of the military mind. It was all very well to cite the general influx of military men as evidence of a trend toward the garrison state. But, when one got down to the specifics of Bradley as Veterans Administrator, or Marshall as Secretary of State, the threat of militarization rapidly evaporated. The professional officers blended into their new civilian milieu, serving nonmilitary ends, motivated by nonmilitary considerations, and performing their jobs little differently from their civilian predecessors and successors. . . . The general ease with which the officers adjusted to their civilian roles and outlook forced their critics to shift to the argument that, although the particular officers appointed were harmless exceptions to the desirable rule, dangerous precedents were being set for the future. This, too, was unconvincing. The "civilianizing" of the officers was not the exception. It was instead the only rule which American liberalism would permit.*[6]

## Economic Aspects of the Postwar Military Establishment

The Second World War was essentially a great crusade for America, and thus was thought of as being temporary and transitory. The Korean conflict was different in many ways from World War II and was much more restricted in area. But its effect on U. S. economic, governmental, and social affairs may be as great. Although it involved but a fraction of the U. S. armed forces used in World War II and required only a partial economic mobilization, Korea awakened America to the communist military threat and, as a result, caused changes in the permanent structure of American society. It left behind an expanded military establishment consisting of two to three million men and women in a permanent, standing military force. This required greatly increased national budgets and a huge, relatively permanent defense industry, wholly or partially dependent on government contracts or controls. The Department of Defense in the post-Korean era was without question the greatest industrial-military activity in the history of the United States and probably in the world. Government purchases became an increasingly larger portion of each industry's expanding market. Military requirements became the most important single element in the U. S. industrial system, so much so that the whole structure of the American economy became dependent, to a degree previously unknown, upon military or defense-associated expenditures. With these developments, the old issue between civilian and military spheres of activities largely lost its meaning.

Regardless of one's viewpoint on the question of antimilitarism versus the military in American life today, it is apparent that the effect of military influences on all aspects of American economic, civic, cultural, political, and governmental activities needs to be thoroughly and empirically examined. As Walter Millis so aptly puts it:

*Military manpower questions, military economics, are not problems arising only suddenly and sporadically in moments of international emergency; they are continuous factors within the fabrics of our society. Military institutions and their consequences are as essential elements of our social and political history as are our religious, economic, legal, or partisan political institutions.*[7]

## Expansion of Military-Community Contacts

The United States today is undergoing significant but little realized transformations in social and psychological attitudes toward its military establishments. These changes, largely engendered by the continuing world tensions brought on by the East-West conflict, are reflected nowhere more dramatically than in the U. S. com-

munity attitudes toward the military. The onset of the cold war since World War II has been accompanied by increased prestige and importance of military personnel in American society, in the economic influences of military activities in America, and in military participation in U. S. affairs.

Since 1945 the effect of military activities on the American economy and on American society has been greater than in any previous peacetime period. Formerly, American military activities were primarily restricted to a few locations in the U. S. and its possessions. In these areas, military personnel and their expenditures usually exerted only minor influences on their adjacent communities. However, this is not the case in the midst of protracted cold war. Today, the national military establishment, the Department of Defense, is *the biggest enterprise that human beings have ever been called upon to manage. In the size, complexity, and diversity of its operations, it dwarfs our largest industrial corporations. It has a payroll of $15 billion a year. It spends $24 billion a year on procurement and construction. It controls 27 million acres of land, 700 major installations, more than 350,000 warehouses, plants, and buildings.*[8]

In the field of local military-civilian relations the armed forces have most frequently come into contact with the civilian community and American society in general. The average American usually receives his personal knowledge of the military through direct or indirect contacts and impressions at the community level where basic attitudes and opinions are formed which, collectively, affect national attitudes and policies. The nation's military leaders are acutely aware of this fact and of the need for local understanding and support of their military activities.[9]

The civilian community and its adjacent military base today make up one large total community with each having a vital stake in the welfare of the other. There are few areas in America today that do not have some type of military activity. As weapon developments allow more of our armed forces to be stationed in the United States, this trend will increase.

The Air Force base complex throughout the world reached an estimated value of ten billion dollars by August 1958. This included 172 major operational, training, logisitical, and research installations in the U. S. and 102 in thirty other nations. Within the U. S. the Air Force was engaged in an extensive program for dispersal of Strategic Air Command units to many more bases throughout the country. Construction to allow the deployment of B-52 and B-47 bombardment squadrons at some forty-eight additional air bases throughout the country was either begun or authorized during 1958. Training and intercontinental ballistic missile bases were constructed or were programmed for many locations throughout the United States in 1958. Additional air defense facilities were built in several areas of the nation to further improve America's defensive capabilities.[10]

Increasing Air Force, Army and Navy activities in all parts of the U. S. thus brought America's armed forces into face-to-face contact with all segments of American society for the first time in our history. The absence of sufficient "on-base" housing, schools, and other family facilities at most of the newer military bases as well as at many of the older installations, has caused great demands on nearby community facilities. Although these communities were greatly benefited by the large increase in local military expenditures that accompany the development of nearby military activities, they may still experience economic difficulties and overcrowded conditions due to the large-scale influx of military personnel and their families.

Often civilians question the reasons why military facilities are located near cities. There are many reasons, of course, with military necessity being the dominant one. It may be cheaper for the government to recondition an abandoned

World War II military facility than to build a new one. One important consideration is the human one. Due to the soaring costs of military construction, such items as family housing often must be deferred. Thus, base locations adjacent to sizable cities allow military personnel to acquire civilian housing for their families and also provide all military personnel opportunities to participate in community social, cultural, and other activities. This, obviously, is a vital morale factor.

The impact of military activities in the U. S. will continue to grow as the cold war progresses. Perhaps the most dramatic change in military activities in America will be the dotting of the nation with missile sites. Missile facilities range from Boeing Bomarc air defense missile sites costing from ten to thirteen and a half million dollars to giant intercontinental ballistic missile (ICBM) installations costing as much as one hundred million dollars for construction alone, projected for dispersed locations throughout the nation. An interesting side light to missile sites is the result of a poll taken in Scottsbluff, Nebraska, to determine how local residents felt about construction of an ICBM base. The Nebraska community approved by a margin of more than four to one. The Scottsbluff reaction is indicative of the general reaction of the American people to military activities.[11]

## Community Reaction to the Military

Many communities have made special efforts to obtain military installations. The intense nationwide competition for the Air Force Academy is a case in point. Communities in forty-four states offered some 200 locations to the Air Academy Site Committee. After months of consideration, Colorado Springs, Colorado, was selected as the site for the academy. The Colorado Springs City Manager, writing in the *National Municipal Review*, pointed out the advantages to his city of the Air Academy:

*Colorado Springs depends largely for its economy on the tourist trade and the military. The development of the Air Force Academy with the expenditure of nearly $150 million for land, engineering, and construction, has assisted materially in this economy. . . . With a total annual payroll of $17 million and $9 million per year spent locally for materials and supplies, the academy will be a major factor in our own stability. . . .*[12]

For a community the size of Colorado Springs, 73,900 estimated population in the city proper and 126,000 estimated in the metropolitan area, the sizable annual payroll and local purchases of the Air Academy plus the eighteen million dollar annual payroll for some 3,000 military personnel and civilians at Headquarters, North American Air Defense Command, Ent Air Force Base in Colorado Springs, represents a significant boost for the local economy.

Military support of local business economies in the United States is one of the outstanding manifestations of the influence of the cold war on American life. Military expenditures of various types probably affect a majority of American communities today, either directly or indirectly, including areas ranging from the smallest communities to the largest metropolitan areas. At one end of the scale, for example, would be Killeen, Texas, the location of the Army's giant training center, Fort Hood. The Killeen Chamber of Commerce stated that sixty to seventy percent of the entire community population, estimated at 22,000 in 1957, "are employed either as military, by the military, or in business or organizations developed as a result of the military." The Chamber of Commerce also reported that ninety percent of Killeen's economy is supported by military activities with the annual local military payroll alone being approximately forty-eight million dollars. Killeen grew from a 1950 population of 7,045 to its present size largely due to the development of Fort Hood, one of the nation's leading military establishments.

At the other end of the municipal scale of American cities greatly affected by military activities could be listed San Diego, California; San Antonio, Texas;

Honolulu, Hawaii, and many others, at which major military installations are maintained and large-scale military expenditures are an extremely important part of the local economy.

Between these two extremes are many other American cities where military activities provide a significant part of the local economy. Montgomery, Alabama, a city of 130,500 with a metropolitan area of some 164,000, contains two air force bases, one of which is the location of the Air University's complex of colleges and schools for professional training of officers, i.e., the War College, the Command and Staff College, and the Squadron Officer School. The Air Force investment at these two bases totals some ninety-seven million dollars. Additional millions of dollars are being invested in the SAGE (Semi-Automatic Ground Environment) air defense installation at Gunter Air Force Base. Military and civilian payrolls at these bases in 1958, plus other Air Force outlays, were sixty-two and a half million dollars. As the Montgomery *Advertiser-Journal* described it:

*Federal funds paid Montgomery schools for schooling of each child of military or Air Force personnel totaled $400,000 in 1958. . . . In the "Operation Spending" category — money that benefits the city directly as it comes from outside the area rather than being local "circulating" dollars — the Air Force increased its payrolls at the two bases to $49,600,000. . . . This money finds its way into business and industrial channels of Montgomery as rent, grocery spending, payments for utilities, and clothing. It shows up in the hands of insurance agents, automobile and furniture dealers, and in every phase of business activities in the local area. . . . The interest of the Air Force family in the Montgomery community is epitomized by the former's activities in local church, civic, and other functions. The bases were the largest "corporate" contributor to the United Appeal again this year. . . . One in each six families in the Montgomery area is an Air Force family, either military or civilian. . . . 7,224 Air Force families (military and civilian) lived outside Maxwell and Gunter during 1958. . . . Thirty percent of the families were listed as home owners in 1958. . . . Maxwell and Gunter personnel owned and operated more than 16 percent of the cars registered in Montgomery County for 1958.*[13]

Fort Knox, a major Army installation located near Louisville, Kentucky, employs approximately 32,000 Army personnel and 5,725 civilians with an annual payroll of approximately $109,000,000. Another $29,000,000 is expended in the area for local purchases and services by the military. Mayor Bruce Hoblitzell of Louisville had this to say about the local Army activities:

*Louisville . . . has had the unique relationship with the military. . . . The result has been an atmosphere of understanding conducive to excellent relationship between civic and military members of our community. It is difficult to outline in detail how military families contribute to the general spirit of the community. We have found invariably when asked to participate in our civic programs that they respond generously. In fact, I know of no program in which they have not been willing to participate with the rest of the community. We feel our "temporary citizens" are fully accepted by the "permanent" residents of our city. . . . The economic contribution they make to the community is tremendous.*[14]

An excellent example of Navy-civilian cooperation can be found in the Newport, Rhode Island, area. Some 10,000 Navy personnel are stationed in Rhode Island on shore duty, while an additional 21,000 officers and men are in the Atlantic Fleet Destroyer Force which has its home port at Newport. It is estimated that some 35,000 Navy dependents reside in the Narragansett Bay area; Newport itself has a civilian population of less than 30,000. As a military newspaper observed:

*The Navy has fifteen separate and distinct commands located in the Narragansett Bay area, and is, without a doubt, the biggest business in the state of Rhode*

*Montgomery, Alabama nestles between two Air Force Bases; Gunter in the foreground, Maxwell on the far side.*

*Island. The Naval Air Station at Quonset Point . . . is the largest single industry in the state, and the spending for procurement and payrolls at this installation is more than the economic contribution of the state's next two largest industries. . . . There is hardly a community endeavor in which Navy people are not involved. . . . There are Navy members of the Community Theater, Navy Scoutmasters, and Navy contributors to every group from stamp collectors to the Engineering Society. . . . Navy people contribute a measure of unique excitement to an otherwise quiet, small-town atmosphere. . . . Local resentment or hard feelings are extremely rare and will never gain an importance because of the mutual recognition of dependence. . . . And how could Newport get along without the economic impetus from the Naval establishment, and without the community spirit shown by its officers and men?*[15]

Wright-Patterson Air Force Base, near Dayton, Ohio, is one of the nation's largest air installations. It houses Headquarters Air Materiel Command, Wright Air Development Center, the USAF Institute of Technology, the Air Force Museum, and other units. It is estimated that

ninety percent of the military families of the base live in the nearby communities with about two-thirds residing in Dayton. Some sixty percent of the military and civilian payroll of this huge base, equaling about one-fifth of the entire civilian payroll of Dayton, is spent in the local market.

City Manager, Herbert W. Starick of Dayton, has stated:

*Military personnel and their families . . . have added materially to the life of the community. . . . We have found them to be active, eager, and constructive participants in many groups. . . . They have applied their cultural talents in education and in the arts and sciences in many ways. . . . They have added to our store of knowledge through our association with them, since they give us an opportunity to learn their way of life under military regulations.*

Another huge Air Materiel Command Base, Tinker AFB near Oklahoma City, employs approximately 20,000 civilian employees. The Oklahoma City Air Materiel Area (OCAMA), which is located at Tinker AFB, is a major overhaul and supply depot for Strategic Air Command aircraft. It does business in some thirteen midwestern states and, at the beginning of the 1959 fiscal year, had contracts with hundreds of manufacturing plants valued at nearly thirteen and a half billion dollars. The St. Louis *Post Dispatch* reported:

*OCAMA, which began its world-wide logistical operations in 1952, had a payroll last year of $105,000,000. . . . The Air Force Center is Oklahoma's second largest industry, led only by oil.*[16]

Hawaii is probably one of the few areas in the United States where all three military services combine to exert tremendous economic and social influences on the local community. There are sixteen military installations on the main island of Oahu alone, including Army, Navy, Marine Corps, Coast Guard, and Air Force bases. The total population of Hawaii in July 1958 was estimated to be 635,000, including over 50,000 military personnel. Since World War II, military activities and expenditures have been the greatest single factor affecting Hawaiian business, employment, and community income. Military spending in Hawaii more than doubled between 1950 and 1957. A recent survey of Hawaiian economic conditions by the Bank of Hawaii included the following statements:

*At present military personnel, civilian defense employees, and the dependents of both groups constitute approximately one-fourth of the population of the Territory. . . . Counting military personnel stationed here, one in four of our entire population is thus directly dependent on defense for a living and substantial numbers are indirectly and partially dependent on it. Practically every wholesale, retail, and service enterprise on Oahu enjoys at least some patronage from military or defense workers' families, and a number of large firms provide goods or construction and maintenance services under military contract. In 1957, military expenditures in the Territory totaled $308 million (more than the aggregate dollar volume of sugar, pineapples, and minor exports).*[17]

In the field of civil-military community relations San Antonio, Texas, occupies a singular position. No other city has served as a temporary, and also permanent home to so many military men. A military element has been a permanent feature in the civic structure of San Antonio since Texas became a state of the Union. The military segment has now expanded to major dimensions. The adjustment that the city has made to this military influx is fittingly described in the following comment:

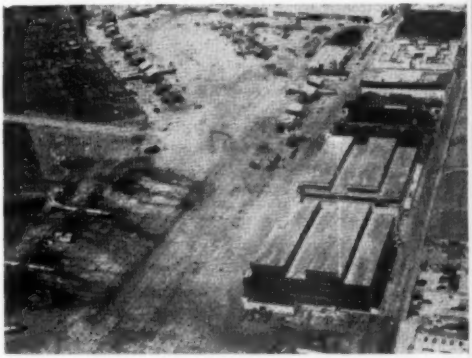
*Knock on almost any door in San Antonio, and you'll see a military uniform. There's probably not a block in the whole city where residents don't include a retired soldier, a veteran, a reservist, a guardsman, an employee of one of the seven sprawling military bases. . . . The military, with its annual payroll of nearly $300 million, is the biggest employer by far, providing take-home pay for nearly a fifth of the city's popu-*

*lation. . . . The city is headquarters for aviation medicine, Air Force training, nuclear weapon storage, and a host of other functions. . . . Shorn of its military nature, San Antonio would not have been the link to statehood, the training ground for millions of soldiers and airmen, the home of heroes, and now — the steppingstone to Outer Space. Moreover, its citizens would lack the political, economic, and social leadership of military commanders and retired leaders including at least 100 generals, plus the solid support of many other retired officers and enlisted men, and its reservists and guardsmen. Mingled with the roar of jets, the tramp of marching feet and the blare of bands . . . will be the heartfelt cheers of San Antonians in salute to the armed forces and their continuing contribution to make the city so fine a place to live that many servicemen decide to stay when they take off their uniforms.*

This stirring editorial, appearing in the San Antonio *Express* in honor of Armed Forces Day, 1959, should make the heart of any American military man swell with pride at so fine a spirit of public recognition. Today in San Antonio, the soldier, the sailor, the airman, the marine, are honored men, accepted in almost every social and economic circle of the community. As the San Antonio *Light* stated editorially on the same day as the above editorial: "No city in the nation has closer ties with the military than San Antonio." These comments by two of San Antonio's leading newspapers appear to reflect the attitudes of the majority of the area's citizens toward their uniformed neighbors, fellow workers, and countrymen. Theo F. Weiss, when President of the San Antonio Chamber of Commerce, expressed the city's appreciation of its military population in these words:

*The servicemen of the San Antonio area are most welcome to the City of the Alamo. A city encircled with military installations . . . a city where the military plays a dominant role in its economy . . . and yet, a city that has somehow achieved a harmonious blending of*

*A portion of Kelly Air Force Base, San Antonio, headquarters of the Air Materiel Command, showing supply warehouses and storage areas in the north section.*



*Maintenance buildings and aircraft overhaul line at Kelly Air Force Base.*

*Supply warehouses and storage area, Kelly Air Force Base east section.*

*the military and the civilian until there is no line of demarcation. As a national magazine recently put it: "San Antonio has the rare civic virtue, much admired by military men, of submitting to the tramp of millions of soldiers for centuries without becoming an Army town." We are proud of this tribute. We are proud that, today, there exists a feeling of great mutual respect and close cooperation—an unspoken arrangement whereby every serviceman is, in every respect, a citizen of San Antonio.*[18]

The military influences discussed above are representative of the impact of United States armed forces on local communities throughout the nation. However, American communities which today have become closely integrated with elements of the armed services are by no means limited to those mentioned in this paper. The extent of military influences on U. S. economic, civic, cultural, political, governmental, and other civilian activities is difficult to assess, especially on a broad nationwide basis. But we can be sure that this intimate relationship now present between the military and civilian echelons of our society will contribute directly to a sounder understanding of the global issues that face this nation today.

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[1]Harold W. Bowman, Brig. General, USAF, "That Military Mind" *Air University Quarterly Review*, Vol. X, No. 3, Fall 1958, p 23.

[2]William R. Tansill, *The Concept of Civil Supermacy Over the Military in the United States: Its History and Practice.* The Library of Congress Public Affairs Bulletin, No. 94 (Washington, D. C., 1951), pp 1-2.

[3]Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations*, (Cambridge, Mass., 1957), pp 361-362.

[4]*Air Force Times*, March 18, 1959.

[5]Arthur A. Ekirch, Jr., *The Civilian and the Soldier*, (New York, 1956), X. *passim.*

[6]Huntington, *op. cit.*, p. 361.

[7]Walter Millis, *Arms and Men: A Study in American Military History*, (New York, 1956), p 306.

[8]*Nation's Business*, June 1958.

[9]Thor M. Smith, Colonel, USAFR, "Air Force Information at the Grass Roots," *Air University Quarterly Review*, Vol. V, No. 2, Spring 1952, pp 82-84.

[10]*Air Force*, August 1958, pp 60, 69.

[11]The Denver *Post*, July 15, 1958.

[12]John M. Berry, "Colorado Springs, Colorado," *National Municipal Review*, November 1958, pp 527-528.

[13]Montgomery, Alabama *Advertiser-Journal*, January 18, 1959.

[14]*Air Force Times*, (Weekend Magazine Section), April 1, 1959.

[15]*Ibid.*, April 8, 1959.

[16]St. Louis *Post Dispatch*, July 6, 1959.

[17]*Hawaii Patterns of Island Growth*, 1958 Mid-year Report: Department of Business Research, Bank of Hawaii, (Honolulu, 1958), *passim.*

[18]*U. S. News and World Report*, July 13, 1959, pp 84-85.

* * * *

If you are always terribly rushed, the trouble with you is that you don't think enough. That's what the late Henry Ford once said to me. Men who have their nose eternally on the grindstone, who are perpetually struggling to catch up with pressing duties, who are always "too busy," are that way, he said, because they don't take sufficient time to think things through. If they devoted serious, intelligent thought to their duties, they would discover ways and means of handling them more quickly, more efficiently. Have you not noticed very often that the men who achieve most appear always to have time to do whatever they take in hand? They don't allow their duties to drive them. They take time to think. Then they take time to act deliberately. They give you the impression of being masters of themselves, masters of their tasks. Is Ford's explanation the right one?

—B. C. FORBES

# BOMBERS OF THE BLACK CROSS

GERMAN BOMBARDMENT AVIATION IN WORLD WAR I

By CAPTAIN RAYMOND H. FREDETTE, USAF

## PART II

### From Kagohls to Bogohls (1916-1918)

FOR THE GERMAN Air Force, the fall of 1916 marked the real beginning of its greatest efforts as the Imperial Army's newest fighting arm. That very next spring German airmen took to the skies with renewed strength and the effervescent hope of victory in their veins.

The fall of 1916 was also the midpoint to oblivion for German military aviation. But before rankling defeat, wings emblazoned with the black cross would fly to Europe's farthest reaches, to the shores of the Aegean, and beyond the Alps, to bring destruction to the cities of the Italian plains. The drone of German bombers would fill the night air over the Thames and the Seine.

As the third year of war dawned over Europe, the disintegration of the German Air Force was still in the dim, uncertain future. For the bombing squadrons there was still time to fulfill a concept that had been frustrated by the waters of the North Sea over two years before.

### A Bomber for the Kagohls

The key to the clarification of the bombardment role, which had been muddled by the mammoth throes of ground warfare, laid in an airplane which would serve but one purpose—bombing. Such a machine appeared just in time to give further impetus to the many revolutionary changes which transformed and revitalized German military aviation in late 1916. The bomber, conceived in 1915 as a truly specialized weapon, had involved long and disappointing trials. The first acceptable series was the G-type which included the famed Gotha, the equally important Friedrichshafen, and, a little later, the A.E.G.[1] (This bomber was named after the firm which produced it, the *Allgemeine-Elektrizitaets Gesellschaft*, which made electrical appliances and light bulbs before the war.)

Though varying in structural details, these airplanes were practically identical in their capabilities as bombers. Approximately 75 feet in wing span, each carried a crew of three in open cockpits. The G-type biplanes were powered by two engines which together exceeded 500 h.p. Armed with three machine guns, these bombers normally carried a bomb load of more than 1300 pounds. On short runs, however, they are on record as having carried the largest German bomb of the time, weighing one metric ton or 2204 pounds.

The revival of German bombing efforts was assured in part with the increase of pursuit squadrons which was well underway by late summer. Use of the Kagohls for aerial combat was lessened proportionately. But the twin-engine bombing plane, which was to become the backbone of German bombardment aviation during the second half of the war, was a more important and indispensable

element for a real, strategic effort. With the appearance of the bombers, the eventual, complete specialization of the bombing squadrons was to be more than mere adherence to concept. It would become a sheer necessity. Due to its size and slow speed, the G-type machine was too vulnerable for any operational use except as a bomb-carrier.

When the British launched their drive on the Somme in July 1916, Kagohl No. 1 was already in the process of converting from the C-type battle airplane to the larger bombing machines. Because of the limited number of the G-types, it was decided to split Kagohl No. 1 for use in different theaters of operations. In directing this action the High Command was once again focusing its attention on distant, strategic targets. The bombing of England with the airplane, though now long delayed, was far from abandoned.

Three squadrons from Kagohl No. 1 were relocated at an airfield near Ghent in Belgium.[2] (George P. Neumann, *German Air Force in the Great War,* Lond., Hodder & Stoughton, 1920, p. 164.) There the crews began special training with the new machines as the nucleus of an entirely new Kagohl, No. 3. Its primary mission was to bomb British targets, a goal which would be realized the following spring with the longer range, two-engine Gothas.

Kagohl No. 1's remaining squadrons also were equipped with the G-type bombers. As the Somme battle was drawing to a close, this splintered half of the battle group was dispatched to Bulgaria[3] (*Ibid.,* p. 158.) to participate in a campaign against Rumania, which recently had entered the war on the side of the Allies. For the Germans, it was a chance to test the G-types in squadron strength. The first capitol to be raided by the new bombers was not London or Paris, but Bucharest.

As winter came, Kagohl No. 1 stayed on in the Balkans to support the Germano-Bulgarian invasion of Macedonia. A Gotha shot down in March 1917 over Salonika, site of the British Army Headquarters in the Balkans, gave the British their first, close look at the bomber that would soon attack London itself.[4] (Charles G. Grey, *Bombers,* Lond., Faber & Faber, 1942, pp. 31-32.) With such, more vital objectives in mind, the German High Command recalled Kagohl No. 1's battle-tested Gothas to the West in May 1917.[5] (Neumann, *op. cit.,* p. 164.)

The other Kagohls, which had remained on the Western Front, also began to convert from single-engine airplanes to the G-types in late 1916. The equipping of some bombing squadrons with the twin-engine bombers immediately precipitated a crisis for German bombardment aviation. It was soon pointed out that certain functions, besides bombardment, performed up to this time by the Kagohls with the all-purpose C-type airplane, remained indispensable. The bombing units themselves felt that some C-types should be retained for tactical operations. Having some value as a fighting airplane, the C-type offered better chances for survival in daylight bombing attacks.

Within the High Command, it was contended that at least some Kagohl squadrons would have to continue as escorts for artillery spotting machines, regardless of the number of pursuit squadrons available for control of the air.[6] (Ernst von Hoeppner, *L'Allemagne et la Guerre de l'Air,* Paris, Payot, 1923, p. 138.) It was even proposed that the bombing duties of the Kagohls be abolished altogether. This was strongly opposed by General von Hoeppner, the Commanding General of the Air Force, who remained convinced of the importance of heavy bombardment despite its lapse during the battle of the Somme.[7] (*Ibid.,* p. 139.)

As a consequence of these varying views as to their future role, not all battle groups were equipped with the G-type bomber. And in early 1917, the most recently activated Kagohls were disbanded altogether as bombardment units. Their squadrons were transferred to the artillery spotting units of the field armies to serve as escort squadrons or *schutz-*

*staffeln.*[8] (The *schutzstaffeln* provide another example of the organizational flexibility displayed by the Germans in adapting the airplane for military use. In March 1918, these squadrons were further converted into combat squadrons, called *schlachtstaffeln,* which served as attack aviation for the close support of ground troops. (See *Ibid.,* pp. 138-139 and 184.) Of the Kagohls remaining, some squadrons retained the single-engine, C-type airplanes for daylight bombing at short-range. The C-V, which appeared in early 1917, had a 240 h.p. engine which added considerably to its value as a bomber, as compared to earlier models of this series.

With only four Kagohls left to conduct aerial bombardment with either the C or G-type bombers, the High Command further decreed that they should devote themselves exclusively to this mission.[9] (*Ibid.,* p. 139.) So it was that while the Germans recognized the need for a distinct and specialized bombardment aviation from the start of the war, it was not actually achieved until early 1917. The long-range bombing concept of 1914 had required technological advances and an organizational evolution for its realization.

### First Trials and Adjustments

The results of these changes were not long in coming. The long projected plans for bombing attacks beyond the Channel were now feasible. Spearheaded by Kagohl No. 3, operating from its base at Gontrode near Ghent in Belgium, the first, sizeable raid on England with the bomber was finally flown in late May 1917. With London obscured by fog, the G-IV Gothas turned to Dover to drop their bombs.[10] (Walter von Eberhardt, *Unsere Luftstreitkraefte,* Berlin, Weller, 1930, p. 138.)

Less than three weeks later, Londoners were more indignant than cowered by the sight of an enemy bomber formation flying in broad daylight over their sprawling city. For them, as well as the residents of English coastal cities, it was the beginning of a harried summer as the Gothas returned more and more frequently. British response to the challenge was sharp and resolute. It took the form of pursuit planes hastily recalled from the Western Front, an increase in antiaircraft guns, and later, the balloon barrage.

By early September, the German raiders had developed sufficient concern for England's aerial defenses to enlist the cover of darkness. In a "moonlight campaign," timed to coincide with the full moon period at the end of the month, German bombers raided the London area on six of eight consecutive nights.[11] (L.E.O. Charlton, *War Over England,* Lond., Longmans, Green, 1936, pp. 90-91.) Londoners sought shelter in the capitol's subways by the hundred thousands. Fortunately for them, the weather during the moon phase in October was not favorable for night attacks. And Captain Kleine, commander of Kagohl No. 3, pleaded in vain for more bombers which he felt were necessary for the complete demoralization of the people of London.[12] (Eberhardt, *op. cit.,* p. 143.)

The airmen flying the Gothas, originally intended as a day bomber, quickly adjusted to their role of nocturnal raiders. This was another important step towards an even greater specialization of German bombardment aviation. Crews trained to bomb individually by night were found lacking in formation flying, an essential aspect of daylight attacks. Day operations often combined the G and C-type machines. The latter flew in a "V" formation enclosing a few of the larger and more vulnerable twin-engine bombers. In this way, the C-type airplanes, also loaded with bombs, performed the dual function of bomber and escort.

Because of the difference in tactics and training, some Kagohls, such as No. 4, became almost exclusively specialized as night bombing units. With the use of signal lights and other ingenious navigational devices, night raids became highly successful against objectives of large proportions. These navigational aids were particularly invaluable in later assaults against the French capitol.

Though raided sporadically by Zep-

*A day bomber and crew of Kagohl No. 4, Staffel 21, in Flanders on the Western Front in late 1917. The pilot at the right, is Lt. Kurt H. Weil, who now heads the Department of Mechanical Engineering at Stevens Institute, Hoboken, N. J. The other airman, Lt. Carl Miller, acted as the observer whose duties included bombing, navigating, and firing the rear gun. An advanced C-type, the machine shown is a D.F.W. C-V, armed with two machine guns, and powered by a 225 h.p. Benz engine. Maximum load carried by this plane with full gas tanks was over 800 pounds.*

pelins since early 1915, Paris felt relatively secure as the German bombers concentrated their efforts against England. Unlike London, that city laid behind the bristling shield of the guns along the front. Its approaches were protected by an inner ring of defenses maintaining the alert since the dirigible attacks. But Paris' sense of unconcern about the war in the air was shaken in late July 1917. Guided by the glare of undimmed lights, two German bombers reached the city.[13] (Comdt. de Castelnau, "Les Bombardements Aeriens de Paris," *Le Correspondant*, Tome 291, 1923, p. 17.) More disturbing than destructive, the raid gave rise to a mood of uneasiness and expectancy in the French capitol. Before many more months, this anxiety was to be justified by events.

As 1917 progressed, strategic air warfare became something more than retaliatory feats of little military significance. In waging the war, air bombardment began to present serious possibilities to strategists of both sides. The more visionary among them even looked upon the bomber as a means of resolving a prolonged conflict which seemed hopelessly stalemated on land.

Without being unrealistic about material effects, the German High Command felt assured that large-scale air attacks with the G-type bomber had been tried and found workable. Undeniably, the most promising strategic targets were to

be found in the midst of Europe's largest cities. But to the Germans, also beginning to feel the stings of the air war at home, concerted raids on the Allied capitols seemed the only effective answer to enemy night bombers ranging up the valleys of the Moselle and the Rhine.

In view of these developments, the German High Command felt the time had come for an expansion of the Army's bombardment aviation. The complexities of long-range operations with the G-type machine also made organizational adjustments necessary. For one thing, even a single battle squadron, equipped with six of the two-engine bombers, found it difficult to locate adequate landing fields.[13] (Hoeppner, *op. cit.*, p. 182.) The squadrons of any one Kagohl normally were scattered about several fields throughout a given sector. Operational control and mobility suffered as a result in the large battle groups. Because of these problems, and the multiplicity of targets, strategic and tactical, the Kagohls had, in fact, frequently operated as half units. This experience was to serve as a guide for reorganizing the Kagohls, consisting up to this time of six battle squadrons.

### Bogohls: A Concept Fulfilled

Beginning in November 1917, the Kagohls were regrouped into new bombing units of three squadrons each. These were renamed *Bomben-geschwadern* or Bogohls.[14] (This term is a contraction of *Bomben-geschwader, Oberste Heeres-leitung,* i.e., Bombardment Group, Army High Command.) The assigning of the title "Bombardment Group" was the final step in establishing a full-fledged German bombardment aviation. Its exclusive, specialized mission was now openly proclaimed in the official designation.

This recognition was amply justified by the advances made that year by the bombing units as a strategic striking force. This progress was reflected to a good extent by the organizational sophistication and degree of specialization within the *geschwader* headquarters staff. A command section issued directives and operational orders for the bombing of objectives, as designated by the High Command. An intelligence officer was on hand to brief the crews on their targets, as well as enemy defenses and tactics likely to be encountered in flight.

Meteorology personnel provided complete data on expected weather conditions.[15] (Jean Abel LeFranc. "Forces Aeriennes Allemandes de Bombardement," *Revue Scientifique*, Annee 56, No 4, 1918, pp. 99-104.) Since visibility was an all-important factor for navigating and bombing, particularly at night, the Germans maintained a highly efficient meteorology service. The *geschwader* staff also included several technical adjutants concerned with aircraft armament and maintenance.[16] (*Ibid.*) Others were solely responsible for the rapid transport of the bomb group in event it were ordered to deploy from one point of the front to another within a few days' time.[17] (*Ibid.*)

By activating three-squadron Bogohls out of the six-squadron Kagohls, the Army High Command had doubled the total of its bombing units. Kagohl Nos. 1, 2, and 4 provided the squadrons for Bogohl Nos. 1, 2, 4, 5, 6, and 7. Though also renamed, Kagohl No. 3 was kept intact with six squadrons, part of which retained the single-engine, C-type bombers. The mission of this group included daylight bombings at short-range, and other specialized tasks of a tactical nature.[18] (Hoeppner, *op. cit.*, p. 182.) The other six Bogohls, however, were to devote themselves to long-range operations with the G-type machines. In the last year of the war the Bogohls had approximately 200 of these two-engine bombers manned by highly experienced crews.[19] (Castelnau, *op. cit.*, p. 8.)

With such forces available, the High Command looked even beyond the Alps for new targets. Shortly after being regrouped in December 1917, Bogohl No. 4 was shuttled by train to the Italian Front. By this time a well-planned German offensive, launched with the Austrians two months previously, was bogged down in trench warfare along the

River Piave. With raids mounted by this Bogohl from captured Italian airfields, the Germans sought to maintain the offensive in the air. Concentrated attacks were made with the G-IV A.E.G. bomber on Venice, Padua, Treviso, and even as far south as Verona. Bogohl No. 4 continued these raids, which proved to be much less perilous than those in the West, until March 1918.

On the Western Front itself, other Bogohls were ready in January 1918, to resume a bombardment campaign that was to continue unabated until just a few weeks before the Armistice. On the last night of the month Bogohl Nos. 1 and 2 were combined for a raid on Paris which commenced at midnight. A German communique later justified the attack as a reprisal for the Allied bombing of Mannheim on Christmas night.[20] (Michel Corday, *Paris Front*, N. Y., Dutton, 1934, p. 313.)

On a more practical side, this first consequential bomber attack on the French capitol also served as reconnaissance in strength of its defenses. The experience gained figured in the planning of two maximum effort raids made on Paris within three nights of each other during the first half of March. These assaults, each lasting for about three hours, were the concerted endeavors of Bogohl Nos. 1, 2, 5, and 7. Unity of command was vested in Captain Alfred Keller, the thirty-six year old commander of Bogohl No. 1. Acting in the name of the Army High Command, Keller issued operational orders and commanded all of the Bogohls in these mass attacks.[21] (Captain Keller was officially designated *Kommandeur von Bombengeschwadern der O.H.L.*, i.e., Commander of the Bombardment Groups of the Army High Command. This flexible arrangement was the closest the Germans came to establishing a unified bomber command during the war.)

Raids on England, however, were lessened considerably since the previous fall. Bogohl No. 3, which had that country as its primary objective, had suffered mounting losses trying to breach the intense defenses of the London area. A further blow was the loss of the group's commander, Captain Kleine, who was shot down and killed, not over London, but on the Western Front in December.[22] (Eberhardt, *op. cit.*, p. 143.) That same month Bogohl No. 3, now sagging in morale and bomber strength, was reinforced with Giant Bomber Unit No. 501 in its attacks on England. Exactly a week before Christmas 1917, the first *Riesen* bomber appeared over London by night to drop a 600-pound bomb near Eaton Square.[23] (E. B. Ashmore, *Air Defence*. Lond., Longmans, Green, 1929, p. 72.)

Undoubtedly inspired by another dinosaur of aviation's stone age, a four-engine Russian plane built by Sikorsky before the war, the Germans had begun experimenting in 1915 with a multi-engine machine intended for use as a night bomber. Two Giant airplane units[24] (Riesenflugzeugabteilung) had been organized in the spring of 1916. But because of the extreme vulnerability of the R-type bombers, their operational use had been limited up to this time to the Eastern Front. As a bomber, the *Riesen* was doomed to early extinction because of its lack of speed, climbing power, and maneuverability. The Germans were unable to overcome these deficiencies with as many as twenty different designs, and the addition of engines which finally reached a total of five. Use of the Giant in daylight would have been suicidal for the crew.

The R-type bomber nonetheless indicates what the Germans might have accomplished if they had developed a wartime engine of more than 260 h.p. Approximately doubling the 78-foot wing span of the G-type bomber, the Giant was capable of staying in flight for as long as eight hours and, on shorter runs, carry up to a two-ton bomb load.[25] (Neumann, *op. cit.*, p. 168.) Some models carried ten crewmen, including two pilots, a radio operator, mechanics, and one man solely concerned with the transfer of fuel from as many as ten tanks of 245 liters each.[26] (Eberhardt, *op. cit.*, p. 441.)

Although primarily intended for raids

*Officers of Bogohl No. 4, serving on the Italian Front in early 1918, greet the crew of an A.E.G. G-IV bomber. This craft was powered by two 260 h.p. engines whose cowling had been removed by the crew. A large biplane primarily used as a night bomber, the G-types carried a crew of three and was armed with three machine guns. The boots and spurs worn by the officers indicates that they were originally commissioned in the cavalry. Officers who became airmen retained the uniform of the arm and regiment in which they had served formerly.*

against targets beyond the range of the G-types, the *Riesen* was increasingly relied upon in early 1918 in maintaining the air offensive against England. In February, for example, the Giants concentrated on attacking English coastal ports. On the night before Paris suffered the first of twin attacks in early March, five of Squadron 501's R-type bombers raided London dropping one-ton bombs on port facilities.[27] (*Ibid.*) On the night of May 19-20 three Giants, accompanied by 32 Gothas from Bogohl No. 3, attacked England's first city for three consecutive hours.[28] (Charlton, *op. cit.*, pp. 96-97.) This raid, which proved to be one of unusually high losses for the Germans, was the last of the war for the British capitol.

Despite its limitations, the *Riesen* bomber was a tangible symbol of German emphasis on concentration of force, a principle which they spiritedly tried to fulfill in the last year of the war. But in striving for decisive effects, the Germans virtually had to rely on the proven G-type bombers of the Bogohls. These bombing units frequently sought to make up for their lesser carrying capacity by flying several sorties against the same target on one night's operation. An outstanding instance of this was the operation of Bogohl No. 4 on the Italian Front in late January. Inspired by the Kaiser's birthday, some of the unit's bomber crews made seven sorties on the same evening to celebrate the event.[29] (Neumann, *op. cit.*, p. 239.)

By one means or another the Germans were intent on delivering the greatest possible weight of bombs on enemy targets. In that last year, each Bogohl dropped an average of 100 tons of bombs per month.[30] (*Ibid.*, p. 167.) This goal was furthered in March with the activation of still another Bogohl, No. 8, the

last group to be added to German bombardment aviation before the Armistice.[31] (Hoeppner, *op. cit.*, p. 218.)

March 1918, which saw the heaviest raids on Paris and the Giants over London, was also the month chosen by the German High Command for the first of a series of offensives designed to win the war. A massive drive, launched on the first day of spring, shattered the British lines on the Somme. German shock troops, especially trained for the assault, combined surprise and a high degree of mobility to spearhead a penetration of 40 miles in little over a week's time.

Bogohl No. 4 with its A.E.G. bombers had been returned from Italy just in time for the offensive. Its squadrons and those of the other Bogohls, which all had been concentrated for the big push, quickly moved up to captured landing fields behind the former Allied front. For some weeks, however, their bombing efforts were largely tactical, being directed against railroad yards and stations to hamper the rail movement of Allied troop reinforcements. Temporarily free from night bomber raids, Paris was now subjected to sporadic shelling by German big guns within range of the capitol.

In other land offensives launched in April and May, the Imperial Army made further, spectacular advances, the like of which had not been seen since the start of trench warfare in 1914. As the German front reached less than 40 miles from Paris, the Bogohls were once more in readiness to concentrate their bombs on the city. Because of the luckless fate of the Gothas over England, the Germans had already announced that reprisals for British air attacks on German towns and cities henceforth would be taken, not on London, but Paris.[32] (*Ibid.*, p. 226.)

Air-raid warnings drove Parisians to shelters with alarming frequency as German bombers nightly winged their way to the Seine like bats out of a cave. During the second half of May alone, the city was raided a half dozen times. The policy of retaliating on Paris was further made good in June with over a half dozen raids. These included attacks conducted on three successive nights at the end of the month. While the destruction was far from crippling, the raids had a pronounced effect on morale. People waited for hours for trains to take them out of the city, and the evacuation of all women, children, and old men was proposed.[33] (Corday, *op. cit.*, p. 351.)

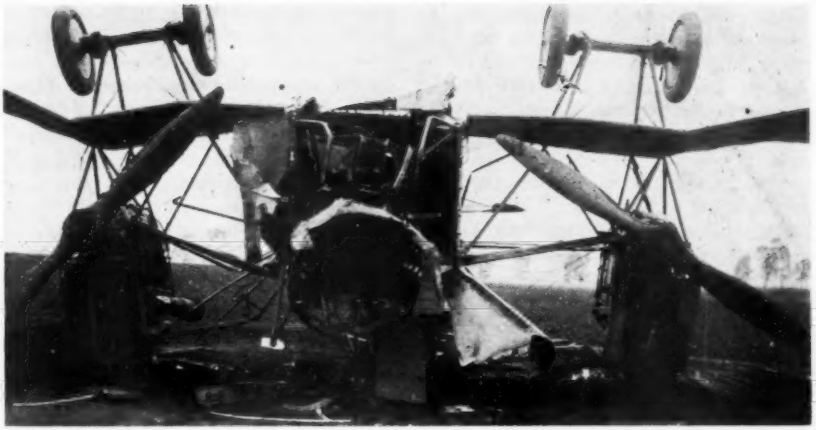
The idea of strategic air attack, a basic tenet of German air strategy since 1914, had prevailed to reach a peak with these concentrated raids during the first half of 1918. The backdrop, however, for the best coordinated strategic air efforts of the Germans in the entire war was, ironically enough, the lowering curtain which was about to bring the conflict to a close. Time was running out for the bombers of the black cross.

### A Concept on the Wane

On July 15, 1918, the German High Command launched still another offensive to pincer off Reims. That battered city formed the apex of a broad triangle protruding into the German lines. The raging battle became so critical that Bogohl No. 1 took to the air in daylight to provide close support.[34] (Hoeppner, *op. cit.*, p. 240.) But the desperate French held Reims against what was to be Germany's last drive of the war.

Paris enjoyed some respite that month as the Bogohls became more and more preoccupied with systematic attacks on the Allies' railroad network and other targets, such as airfields, ammunition dumps, and supply depots, immediately behind the front. The G-type bombers were largely ineffective in locating such small, isolated objectives. And it was even less likely that their bombs would find their mark by night. To better support land operations, Bogohl No. 7 and other units reverted to using the C-type machine for the daylight bombing of tactical targets in the battle area.

By August, the pendulum had begun to swing against the Germans as their exhausted troops were unable to advance any farther. The iron prow of the Im-



*Bombing by night added to the hazards of combat flying. This A.E.G. bomber, returning from a mission, crashed during a night emergency landing in a field near Gembloux, Belgium in 1918. The crew of three, however, escaped without injury. Had he reached his base, the pilot would have been able to land in the glare of lights which were turned on for returning bombers upon the flashing of a coded signal to ground crews.*

perial Army, which had rammed huge dents into the Allied front without piercing it decisively, was being eaten from within by the rust of attrition. Rather than risk their now brittle front, the Germans fell back under the steady pressure of Allied counterattacks now stiffened by fresh American troops.

As the German retreat began, slowly at first and then accelerating in its pace, the Bogohls had to abandon their forward fields so temptingly close to the French capitol. Other problems included the supply of gasoline, now down to a rationed trickle even for combat air units at the front.[35] (*Ibid.*, p. 255.) Still, the German bombers returned to Paris in mid-August to inflict a night raid which lasted for two hours.

Sound doctrine gave way to desperate expediency as the tactical situation deteriorated along the Western Front. The Germans resorted to using the lumbering Giant bombers against small targets as close as 15 miles behind the lines with disastrous results, in most instances, for plane and crew alike.[36] (Neumann, *op. cit.*, p. 190.) For the Bogohls, the flight distance to Paris continued to increase almost daily as more airfields had to be abandoned, one after another, before the advancing Allied troops. In plowing up its landing strips and blowing up its hangars, the German Air Force was literally burning up its bridges. But the Bogohls paused long enough for still another fling against the French capitol. The final raid on Paris was flown on the night of September 15-16.[37] (Jules Poirier, *Les Bombardements de Paris*, Paris, Payot, 1930, p. 158.)

The German bomber crews, who took to the skies that night, were not aware that this was to be the last strike against one of their biggest objectives of the war. For just one week later, the Bogohls were ready and still capable of launching an even greater raid calculated to cause untold havoc in London as well as Paris. The operation, secretly planned since August, called for the dropping of nothing but small, two-pound, magnesium incendiary bombs, especially manufactured for the occasion.[38] (Castelnau, *op. cit.*,

p. 21.) With simultaneous raids on both Paris and London, the Germans hoped to start thousands of fires which would be beyond the control of fire fighters. The raging flames, it was estimated, would consume the heart of the enemy capitol cities.

The massive fire raids were scheduled for the night of September 23, 1918. By early evening the bombs had been loaded and the crews briefed, but the bombers never left their landing fields.[39] (Hauptmann Hermann, *Luftwaffe*, N. Y., Putnam's, 1943, pp. 3-4.) The terrible scourge of the fire raid, so carefully planned by the Germans, would have to await still another World War to be flown. Then it would have its greatest success, not only in London, but in other cities far from the old Western Front, places such as Hamburg and Tokyo. By this time the devastation was far beyond what the Germans could possibly have hoped to achieve that September night just seven weeks before the Armistice. But as a concept for strategic air warfare, little was to be added in the intervening years.

The Bogohls, however, had been overtaken by the sweep of greater and unalterable events that were about to end the war. The German High Command, whose prerogative it was to unleash the bombing squadrons on their long-range missions, now felt compelled to call off the night bombers. With an armistice rapidly becoming unavoidable, it was realized that Germany would reap little advantage by inflicting such havoc on the capitols of adversaries soon to be acknowledged as victors.

In the few weeks ahead there remained nothing for the Bogohls, or for the rest of the German Air Force, but a series of hectic flights taking them ever farther eastward. Their days of dealing destruction from the air were over. Sudden death need not be anticipated any longer by the bomber crews who had challenged and survived the blinding lights and flashing guns of London and Paris. For them, there was nothing left but a retreat affording no rest, the disintegration of their squadrons, the blowing up or surrender of their machines, and the disillusionment of a generation of German airmen who, having flown in vain, would fly no more.

### The Oblivion of Defeat

It has not been intended to magnify the accomplishments of German bombardment aviation during the first World War. As is well known the outcome of the war was decided by the consuming and prolonged struggle on the Western Front, and the exhausting levies it imposed on the life blood and resources of the belligerents. What war-making capabilities were destroyed by the bombarding air forces of either side are, by comparison, of little consequence. Quite apart from assessing its military significance, the primary concern here has been to trace the beginnings of long-range, aerial bombardment from other than Allied experience alone. Or, if you prefer, to give the devil his due in the development of what was a new concept and method of warfare.

Although Germany provided in many respects the groundwork for this new dimension in war, that country's first contribution to air doctrine is rarely evaluated in proper perspective. Many accounts of the early attempts at strategic air warfare give most of the credit, if not all, to the British for leading the way in the "dawning of a revolution in arms."[40] (Cf. Dale O. Smith, *U. S. Military Doctrine*, N. Y., Duell, Sloan, 1955, pp. 121-123.) Creation of an autonomous Royal Air Force, as well as an Independent Air Force for attacks on the "German industrial system," are quite correctly given in evidence. But this organizational development, as opposed to one of concept, is often cited as the beginning of strategic bombing.[41] (Gerald Bowman, *War in the Air*, Lond., Pan, 1958, p. 13. The author quotes Air Chief Marshal Sir Philip Joubert as follows: "The bomber squadrons of the Independent Air Force (within the RAF) were the first to start attacking German industrial targets beyond the Rhine. This was the first strategic use of air power — the

first step which started us along the road to where we are today.")

Oblique reference is made, of course, to the "Zeppelin raids" as the stimulus for British action. But the setting-up of a strategic IAF in June 1918, came a full year after the Germans had started a serious, bombing campaign against England, and not with the dirigible, but the bomber. Time-wise, the IAF was actually formed only after the Germans had bombed London for the last time. Without minimizing their contribution, it would appear that the British learned to appreciate air power at the receiving end of German bombs. To retaliate in kind was a most logical response, but still only a response.

In a real sense, the oblivion to which early German bombardment aviation has been assigned is a consequence of defeat. In developing strategic air power, the pioneering efforts of the Germans went into eclipse in early 1919. Germany had developed her air units to such a level during the war that the Allied powers were fearful of allowing her even a minimal air force. Along with the submarine, the night bomber was specifically cited in the terms of the Armistice as a weapon to be surrendered "in the first place," and in its entirety.[42] (Harry R. Rudin, *Armistice 1918*, New Haven, Yale, p. 426.)

Therein lies a paradox. By being first in the air in so many ways, Germany became last. Obviously, without a preponderance of the means needed to win, advanced concepts or superior tactics only serve to stave off but not avoid defeat in an extended conflict such as World War I. And for many years afterwards, Germany's only contribution to air doctrine was the naval war prizes which turned turtle under the impact of Billy Mitchell's bombs off the Virginia Capes.

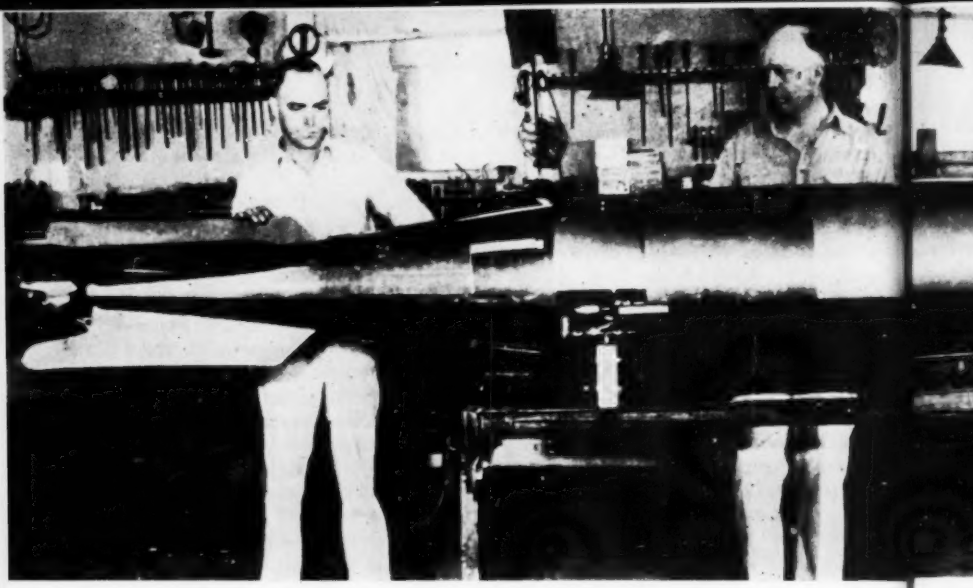
As far as the historical record is concerned, no small advantage is accrued by the victors in any war. But because the wings of Germany's first air force were broken by fiat, its story reads like an unfinished book, something which is never easy to evaluate. Even to the serious analyst, the chronicle of early German military aviation is a truncated bit of air history. It hardly seems worthwhile to explore in depth because the interplay of cause and effect is analyzed best along an unbroken thread of events.

It is easier to trace military air developments in terms of the Royal Flying Corps which evolved into the world's first independent air force, and which went on to emerge victorious in two global wars. For these reasons, very likely, the narrative of German air power in the first of these wars is rarely considered for its own sake. German efforts remain a s h a d o w y, short-lived element, cited merely as the spur for British advances.

Oblivion for the first bombers of the black cross was further assured by lack of continuity in concept as well as time. Revival of German air power came in the form of a politico-tactical hybrid of an air force, more imbued with Nazi ideology than sound air doctrine. Geared for bluff and terror, Germany's own first, independent air force was largely ineffective without the Panzer divisions it was designed to support.

The German bombing squadrons of World War I tried to fulfill a valid concept with an air weapon of extremely limited capabilities. A few decades later when technological progress made a potent, strategic weapon available, the Germans saw no need for it. Lacking heavy bombers, the Luftwaffe was an emasculated air force which proved itself impotent for strategic air warfare.

Thus, for basically different reasons which led to the same practical results, the German Air Force of two wars was unable to achieve decisive results against its insular enemy beyond the Channel. The Nazi air strategists could have created a powerful, strategic air force. Fortunately for Great Britain, and indirectly this country, they chose instead to ignore, not only the hard core of the postwar Douhet formula, but also the battle-tested principles which had guided and inspired the Luftwaffe's imperial predecessor.



# Yesterday's Dream . . . Today's Reality

A Biographical Sketch of the American Rocket Pioneer, Dr. Robert H. Goddard

By DR. EUGENE M. EMME
Historian
National Aeronautics and Space Administration.

*In these days of rapid rocket and guided missile development, it is easy to overlook the great deal of pioneering that went into the development of the rocket art, and particularly the degree to which rocket development had been carried in this country before the second World War.*

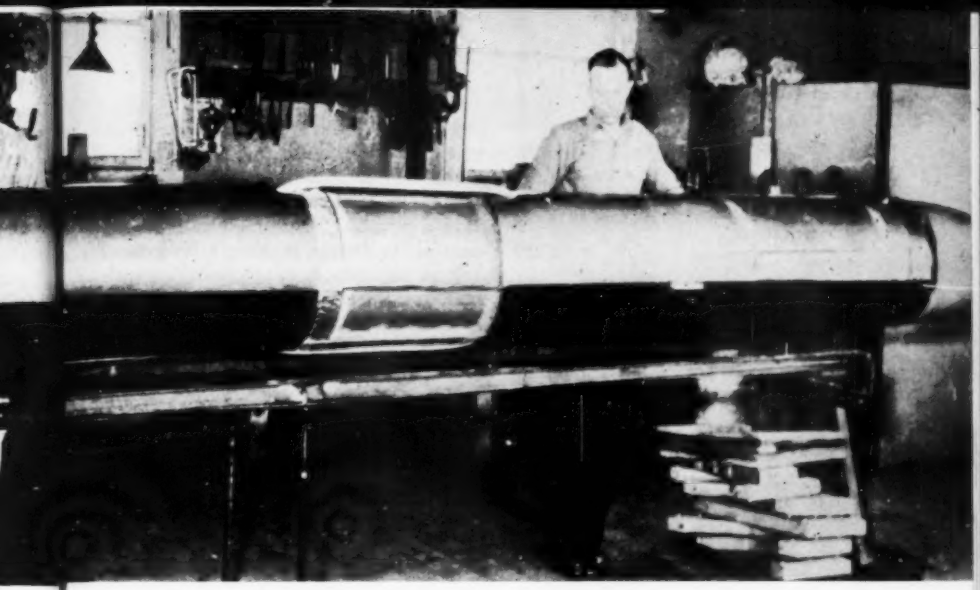
*The accompanying photograph of one of Dr. Robert H. Goddard's pioneering liquid-fuel rockets was made in the spring of 1941, and shows the degree to which development had been carried by him at that time. The picture was presented to Harry F. Guggenheim by Dr. Goddard on December 28, 1944, a few months after the V-2 rockets began falling on London. Dr. Goddard inscribed on its back these words:*

*"Rocket produced in New Mexico in the spring of 1941, under the Daniel and Florence Guggenheim Foundation.*

*"It is practically identical with the German V-2 rocket."*

*This 1941 rocket had the following features in common with the later German V-2's, among others: (1) a similar arrangement of propellant tanks (2) a general similarity of shape and placement of major parts (3) liquid oxygen and alcohol as propellants (4) gyro-stabilization and gyro-control (5) steering by means of fins placed in the motor jet, plus steering by means of movable vanes in the airstream (6) pumps to drive the propellants into the motor.*

*Dr. Goddard's gyro-controlled rockets weighed from 58 to 85 pounds at starting, and were 10 to 15 feet in length. A large number of successful shots were made with them, some reaching altitudes of more than 7,500 feet.*



*"It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow."*
—DR. ROBERT H. GODDARD (1882-1945)

I

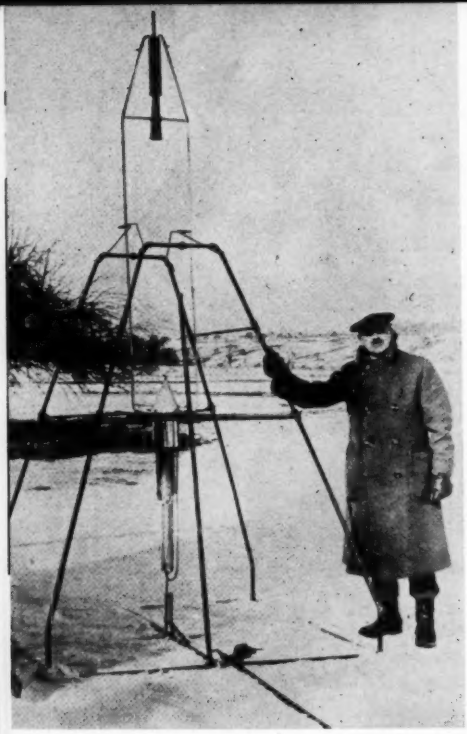
THE FATHER of modern rocket propulsion is the American, Dr. Robert Hutchings Goddard. Along with Ziolkovsky of Russia, Oberth of Germany, and others, Goddard early envisioned the exploration of space.

A physicist of great insight, Goddard also had a unique genius for invention. He not only realized the potentialities of space flight but also constructed, static tested, and launched rockets to confirm his propulsion theories and engineering solutions. This rare talent in both creative science and inventive engineering places Goddard high among the rocket pioneers. While his scientific papers were copiously studied, however, his speculations and experiments were ridiculed, and his genius was largely unappreciated in his own day. Little wonder that this modest man once called "the moon-rocket man" and "Moony" has only recently been fully recognized.

By 1926, Goddard had constructed and tested successfully the first rocket using liquid fuel. Indeed, the flight of Goddard's rocket on March 16, 1926, at Auburn, Massachusetts, was a feat as epochal in history as that of the Wright brothers at Kitty Hawk. Yet, it was but one of Goddard's "firsts" in the now booming significance of rocket propulsion in military missilery and the scientific exploration of space.

As primitive in its day as the achievement of the Wright brothers, Goddard's rocket success made little impression upon responsible government officials. Modest grants from the Smithsonian Institution, and later grants from the Daniel and Florence Guggenheim Foundation as well as a protracted leave of absence from Clark University (where he was Head of the Physics Department) — these largely enabled Goddard to sustain a lifetime of devoted research, development and flight testing.

Eighteen years after Goddard's successful demonstration at Auburn, his basic concepts and many of his technical designs came to world-wide notice in the German V-2 ballistic missile. The advent



*Dr. Robert H. Goddard standing beside the world's first liquid fuel rocket. This liquid oxygen-gasoline rocket was successfully fired on March 16, 1926, at Auburn, Massachusetts, what is now called the "Kitty Hawk of Rocketry."*

of intercontinental missiles, earth satellites and spacecraft was not only based upon that to which Robert H. Goddard devoted his creative talents, but also opened up a new era in the accelerating impact of science and technology upon the affairs of mankind.

## II

Robert H. Goddard's notebooks date back to 1898. Begun when he was sixteen years of age, they contain his speculation about the use of rockets for exploring the atmosphere and beyond. In December 1901, Goddard wrote a short article on space navigation. It was submitted to the *Popular Science Monthly* and was rejected.

Six years later his thoughts were expressed by both deed and word. He reportedly obtained some public notice in 1907 from a cloud of smoke eminating from a powder rocket fired in the basement of the physics building at Worcester Polytechnic Institute. School officials took lively interest in this work of student Goddard, but they did not expel him. That same year Goddard prepared an article suggesting that radioactive materials might provide a means of propulsion sufficient to navigate into interplanetary space. He submitted it to the editor of *Popular Astronomy* for publication. It was rejected with the comment: "You have written well and clear but not helpfully to science as I see it."

Based upon continuing research and study, Goddard received two U. S. patents in 1914. One was for a rocket using liquid and solid fuels, the other for a multistage rocket for reaching high altitudes. He began actual experimentation as an honorary fellow in physics and instructor at Clark University. At his own expense, he made systematic studies of propulsion. He proved both mathematically and in the laboratory that rocket propulsion will function in a vacuum. Reaching the limit of his personal financial resources by 1916, Goddard wrote a lengthy technical paper on his work to date and on the potentialities of rockets in order to gain financial support. This was his classic paper that resulted in a $5000 grant from the Smithsonian Institution in 1917, through the efforts of Dr. Charles D. Walcott, its Secretary, and Dr. Charles C. Abbot, his successor as Secretary. Dr. Walcott was also very instrumental in the early days of the National Advisory Committee for Aeronautics (NACA).

Goddard's 1916 essay requesting funds so that he could continue his research was later published along with his subsequent experimentation in the *Smithsonian Miscellaneous Collection for 1919.* It was entitled "A Method of Reaching Extreme Altitudes." Like all Smithsonian publications, it was available to the rest

of the scientific world. Upon request, Goddard sent an autographed copy to Hermann Oberth of Germany in 1922 and received a warm letter of thanks from the early German pioneer of rocketry.

Towards the end of his report Goddard discussed the possibility of a rocket reaching the moon and exploding a load of flash powder there to mark its arrival. His scientific report was largely a dry explanation of how he had used the $5000 grant in his experimental testing of earlier mathematical theories of rocket propulsion in the search for methods of raising weather data-recording instruments higher than sounding balloons. A representative of the press in Washington, however, made of Goddard's report the first genuine proposal for interplanetary travel. Goddard's scientific thought about a rocket flight to the moon was quickly generated into a heated journalistic controversy concerning the feasibility of such a thing. Much "moon-rocket man" ridicule came Goddard's way. His attempts to minimize the sensational only fanned the flames. He thus reached reservations in 1920 about the virtues of the general accuracy of the popular press, a viewpoint he apparently held for the rest of his life. Several score of the 1750 copies of the 1919 Smithsonian report reached Europe, according to Willy Ley.

Goddard's work with the U. S. Signal Corps during World War I should also be recalled. Until 1917, Goddard had done most of his laboratory research on breechblock and feeding mechanisms for dry-fuel rockets. One of these rockets blew up in the Magnetic Laboratory of Worcester Polytechnic Institute on July 9, 1917, much to the notice of the surrounding neighborhood. Between 1914 and 1917, Goddard was granted seventy patents on rockets and rocket apparatus. In correspondence with General H. H. C. Dunwoody, he offered to investigate possible military applications of his rocket.

In January 1918, Goddard received U. S. Signal Corps financial support. He worked on two projects: (1) a rocket for long-range bombardment propelled by a solid-fuel rocket motor charged intermittently like a repeating-rifle; and (2) the progenitor of the famed "bazooka" rocket mortar of World War II fame.

The bazooka-type rocket was demonstrated at the Aberdeen Proving Ground in early November 1918. The launching platform consisted of two frail music racks to demonstrate the absence of recoil in rocket firing. This test was highly successful both as to trajectory and target impact. U. S. Army Air Service representatives strongly recommended its development for future combat employment. But the Armistice put an end to the war as well as to the active interest of the U. S. Army in rocket experiments until World War II. Things were different in Germany and Russia before World War II, but that is another chapter in the history of rocket propulsion.

## III

Goddard's great engineering achievements resulted from his work in the 1920's and the 1930's. On November 1, 1923, he static tested a rocket motor using liquid oxygen and gasoline fuel, both supplied by pumps on the rocket. By December 1925, this motor was operated independently of the testing frame. And on March 16, 1926, this rocket flew 184 feet in 2.5 seconds, the world's first liquid fuel rocket flight. This was a historic event.

His last rocket flight at Auburn, on July 17, 1929, was witnessed by observers who thought it a flaming airplane and called out ambulances. The roaring rocket was heard all over town by most citizens. The wire services quickly spread the word that Professor Goddard's moon rocket had exploded violently. The Massachusetts Fire Marshall prohibited future rocket launchings within the boundaries of the State of Massachusetts. Even the Smithsonian quickly commented that "no such project as going to the moon is contemplated." Significant to note, this highly publicized flight carried an instrumented payload, an aneroid barometer,

thermometer, and a camera triggered to operate when the parachute opened. They were successfully recovered. This was another historic first. In spite of the unwarranted publicity given this flight, it was thus that Goddard's work attracted the attention of Charles A. Lindbergh. Lindbergh personally visited Goddard and, recognizing the scientific significance of his work, enlisted the support of Harry F. Guggenheim and his father, Daniel Guggenheim.

The Smithsonian had, by this time, supported Goddard with $11,000. Between 1929 and 1941, Daniel Guggenheim and later the Daniel and Florence Guggenheim Foundation provided Goddard with over $150,000. This money supported his development of large gyro-controlled pump-operated, liquid-fuel rocket experiments in New Mexico. Progress on his work was described in "Liquid Propellant Rocket Development," published by the Smithsonian in 1936. This modest financial aid supported the pioneering efforts of Goddard which ultimately created a multibillion dollar industry and brought forth the enormous potentialities of long-range missiles, earth satellites, and space flight.

Goddard's work largely anticipated in technical detail the later German V-2 missiles, including gyroscopic control, steering by means of vanes in the jet stream of the motor, gimbal-steering, power-driven fuel pumps and other devices. Wernher von Braun, now Director of the National Aeronautics and Space Administration Marshall Space Flight Center, has said that when he had the opportunity in 1950 to study the Goddard patents he was "virtually overwhelmed by the thoroughness of his work and found that many design solutions in the V-2 rocket were covered by Goddard patents."

But Goddard, however, sought no publicity and did not widely make known details of his work. He called his rockets "Nell" after the girl "who ain't been done right by." When asked by then Lt. Homer Boushey of the Army Air Corps in 1940 why he did not publicize his work, Goddard stated that his earlier publications had been translated and reproduced in Europe virtually verbatim, often without mention of Goddard or their source.

During the late 1930's, Goddard unsuccessfully tried to interest the War Department in the military utility of his rockets. Dr. Theodore von Kármán's group at the California Institute of Technology and the Army Air Corps showed some interest in Goddard's work but nothing tangible resulted. In 1941, the Navy became interested in jet-assisted take-off and rocket bombs, and finally enlisted his services. One of his young assistants from Clark University in 1918, Dr. Clarence N. Hickman, also provided continuity on the development of the World War II bazooka. Goddard worked on rocket projects at the Naval Experiment Station at Annapolis from 1941 until his death, following a throat operation, on August 10, 1945. His work at Annapolis remains obscure.

## IV

Praise of Goddard's basic work is in vogue today.

In hindsight, Dr. Robert H. Goddard was one of the first scientists who realized the potentialities of space flight and missiles. But he also brought them to a practical state of development. This rare creative and practical talent was, as Mrs. Goddard points out, combined with his dogged persistence and methodical scientific dedication. More than 200 patents on rockets and rocket apparatus have been issued to Robert H. Goddard, many since his death.

The labors of this scholarly modest man were appreciated by experts but went largely unrecognized until the recent dawn of what is now called the "space age." High honors and wide acclaim, belated but richly deserved, now come to the name of Robert H. Goddard. On September 16, 1959, the 86th Congress authorized the issuance of a gold medal in his honor. Goddard dinners and awards are annual events of the American Rocket Society, the National Rocket

Club, and the Air Force Academy. On June 28, 1960, the Smithsonian bestowed on Goddard its highest award, The Langley Medal. And, on July 13, 1960, the American Rocket Society erected a fitting memorial on the site of the world's first liquid-fuel rocket flight of 1926 at Auburn, Massachusetts.

NASA's new Goddard Space Flight Center, with its important responsibilities, is a living and working tribute to his historic contributions in the exploration and investigation of space. Once his biography, notebooks, and papers are fully available, Robert H. Goddard's trailblazing role in the theory and application of rocket propulsion will be even more greatly appreciated.*

* As this article went to press, settlement of patent claims of the estate of the late Dr. Robert H. Goddard, pending since 1951, was culminated on June 29, 1950. Past infringement and paid-up license for all future use by the government of all Goddard inventions and patents will be exchanged for payment to the Guggenheim Foundation and Mrs. Goddard of $1,000,000 ($765,000 by the Air Force, $125,000 by the Army, $100,000 by NASA, and $10,000 by the Navy).

## BIOGRAPHICAL NOTES

No full-fledged biography of Dr. Goddard is available. His notebooks, correspondence, and papers are being edited by Mrs. Goddard with the assistance of the Smithsonian Institution and the Daniel and Florence Guggenheim Foundation. Mr. Milton Lehman of Garrett Park, Maryland, is completing a definitive biography. He was helpful in the preparation of this sketch while Mrs. Goddard generously made corrective suggestions. A select bibliography was included to guide the stimulated reader until Mr. Lehman's biography appears and Dr. Goddard's papers are placed in the Library of Congress.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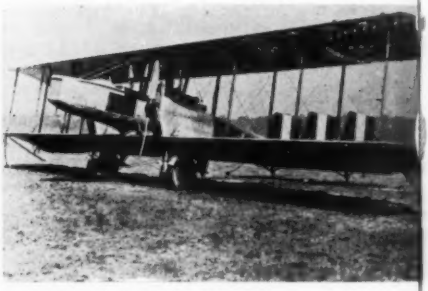
# A LESSON IN TIMING

*NIEUPORT Pursuit (French)*

*SPAD 15 (French)*

*The BREGUET 14 (French)*



*Standard CAPRONI Biplane (Italy)*

*THE FOLLOWING report clearly discloses the price that must be paid and the hazards that must be faced in military actions when comprehension is foggy and dull. Not sensing the impact of the air arm as a distinct category of conflict in the conduct of war, no timely provision was made for creating and effectively employing this unique military force in World War I.*

*Responding to hindsight, rooted in the superficial experience of our allies, America belatedly endeavored to improvise an air arm in its military posture. It produced too little and it came too late to give meaningful demonstration of air power's decisive military features. This convincing disclosure had to await another global war.*

*The author discloses that he sensed the magnitude of the problem that inaction had imposed. He recognized many of the obstacles to the creation and rapid growth of the air arm, but history discloses that he didn't see them all. Had the War carried on a few more years, air power should have grown to significant dimensions.*

45 Avenue Montaigne, Paris, France.

August 15, 1917

From: Major R. C. Bolling, S.O.R.C.

To: Chief Signal Officer of the Army, Washington, D. C.

Subject: Report of Aeronautical Commission.

1. The Aeronautical Commission under my charge left New York on the steamship "Adriatic," June 17, 1917, landed at Liverpool, June 26, 1917, proceeded to London, remained there about a week, proceeded thence to Italy, remained there about ten days, returned to Paris and remained there about ten days. Thereafter the party was divided according to new instructions and duties. I was instructed by General Pershing to remain in Paris to take command of aviation matters in the Zone of the Interior, so called, and I have retained with me Captain Gorrell, Major Glendenning, and Captain Hughes, the two latter having been intended to be located permanently in Paris. Messrs. Vail, Burley, and Heilman have remained in Paris to complete work upon which they were engaged. Commander Westervelt, Lieutenant Child, Captain Clark, Captain Marmon, and Mr. Stay have proceeded to England to complete certain work begun there, with instructions to sail for America at the earliest possible date. All the members of the Commission returning to America have been instructed to prepare reports upon the special subjects of their investigations and to submit those reports immediately upon their arrival at Washington. This report will, therefore, cover only the general investigations of the Commission, and is to be supplemented by the technical reports of the various members as stated.

2. The general subjects of our investigations may be classified as follows:

## A. Royalties or Rights to Manufacture in America for the Duration of the War Types of Foreign Airplanes, Engines, etc.

The principle with respect to this matter adopted by the Aircraft Production Board and the United States Government before we left America was that there should be free exchange of all such rights among the Allied nations for the duration of the war. The only exception to this rule was the arrangement made by the Aircraft Production Board with the French High Commission in Washington respecting the payment to the French Government of $100,000.00 each for three types of airplanes and three types of motors thought to be immediately desirable in America. This exception was specifically stated not to be in derogation of the general principle established.

On reaching England I announced the position of the United States Government to the British Air Board and it was discussed between us at length, and in detail. It was deemed of such importance in its industrial and political aspects that I was informed it must be laid before Mr. Lloyd George and the Cabinet; but the British Air Board recognized the broad equities of the position taken by the United States. After our numerous conferences I was informed that the British Government accepted the principle presented by the United States, assumed all responsibility to the British manufacturers and agreed that the United States, during the duration of the war, might manufacture or cause to be manufactured all types of British airplanes and engines recommended and adopted for quantity production in the United States.

In France the situation in respect to this matter was, and is, extremely complicated. The political situation has been such that the French Government has not felt willing or able to take a bold stand in respect to this matter. At the beginning of the war the need for airplanes and engines was so great and so urgent that all the European Governments simply accepted practically any terms offered by the manufacturers including very high royalties for the rights to have types of airplanes and engines manufactured elsewhere than in the factories of the owners of such rights. These rights were recognized and the royalties paid both by the home governments and by any foreign governments desiring to have these types of airplanes and engines manufactured. I understand that the British Government subsequently commuted many of the royalties paid to its own manufacturers; but the French Government has never felt that it was in a position to do this, although the matter is now under consideration. In Italy the matter is in abeyance and now under consideration. The whole situation is also complicated by the fact that the rights respecting the Hispano Suiza engine emanate from the Spanish Hispano Suiza Company of which I am informed that a majority (said to be four-fifths) of the stock is owned by the King of Spain. This seems to have created certain international and diplomatic aspects to the matter which have somewhat embarrassed the French Government. Furthermore, the political situation in France seems to have prevented any very determined attitude on the part of the French Government in dealing with its own manufacturers.

When I arrived I found that the French had construed the cable from M. Tardieu regarding the $100,000.00 payments as a firm offer of that amount for each of the airplanes and engines mentioned, whether we subsequently decided to build them in America or not. The wording of Mr. Tardieu's cable which was shown me certainly permitted such construction. Had the French shipped the airplanes and engines immediately and otherwise carried out their part, the situation might have been embarrassing; but when I returned from Italy I found that this had not been done. I thereupon took the position that $100,000.00 would be paid only to those manufacturers whose airplanes and engines were adopted for quantity production in the United States. Under our recommendations this would include only the Spad airplane and the Hispano Suiza and Gnome Le Rhône engine manufacturers. Both the latter have given some sort of rights to American manufacturers. With respect to these I have taken the position that our rights must emanate directly from the French manufacturers, and that they must settle any controversies with the American grantees of rights to manufacture these engines. As the engines either will be in America or on their way by the time this report reaches you with full data and engines to assist in the United States production, I think this practically settles the matter. As I understand it, these so-called rights are not protected by patents, but rest in the power of the manufacturers either to disclose or conceal the details of manufacture which make it possible to successfully produce the engines. With the sample engines, full details and assistance of the French engineers, it seems you are in a position to produce these engines independent of the American grantees of any so-called rights. If these American grantees have any claims against the French manufacturers based upon contract the French manufacturers will have to deal with that situation themselves as I have told them. I do not see how the American grantees can enforce any claims against the United States Government.

However, you will see that it would be inconsistent for us to say to the British and French Governments that they must take care of the situation with respect to their citizens unless we also say that we will take care of the situation with respect to our citizens. In that, I do not see any difference between citizens of the United States who have such so-called rights by reason of being the manufacturers of airplanes or engines and American citizens who have such so-called rights by reason of licenses

which they have purchased. We must take care of the situation in America if the foreign governments are to take care of the situation in England and France.

With respect to any claims for future royalties, I have taken the position that while the matter was left open for subsequent negotiation under your arrangements with Mr. Tardieu and I will listen to anything the French Government or its manufacturers care to say on the subject, I cannot entertain any such claims. The action of the British Government makes it possible to maintain this position. Meanwhile you will be put in a position to go ahead and manufacture the airplanes and engines, which seems to me to settle the matter. While there may be some further talk, I think this disposes of the French royalty situation.

The Italian Army officers in charge of their production recognize the justice of the American position with respect to royalties. They now have under advisement their own relations in the matter to their manufacturers. The situation is simplified somewhat by the fact that most of the developments in Italy have been carried on under Italian Army. They have already dispatched to America everything which we asked and I do not anticipate any difficulty in dealing with the royalty situation, although it may be necessary to make some moderate payment such as will be given to the French. The Caproni is the only Italian airplane at present recommended for American production, and by the time this report arrives you should have all you need to start its production.

### B. Sample Airplanes, Engines and Data Necessary for their Production.

I fully appreciate the disappointment which must have followed the delays to get the desired sample airplanes and engines and information covering their manufacture in America. We have felt that disappointment as much as anybody could; but every possible action has been taken by us to expedite the matter here. In England and Italy I think the airplanes, engines, etc. were dispatched as promptly as could be expected under the circumstances. In France the United States requirements had been indicated and agreed to before we arrived and we were told that everything was either already on the way to port or being prepared for immediate shipment. It was not until we returned from Italy and Major Tulasne was given charge of the situation that we found practically nothing had been done. As I have indicated, there had meanwhile occurred one of the frequent changes in the French Government department in charge of the matter. All I can say is: first, that you can hardly realize the difficulties of apparently simple matters of this sort in countries where every bit of transportation and everything else is part of a complex and cumbersome system of military administration; second, that the foreign manufacutrers have a surprising lack of data covering articles of their manufacture. In most of the airplane and engine factories they are entirely without complete drawings, specifications, and other tabulated information which we should consider essential to the manufacture of airplanes and engines. After all, you may well consider in this connection what would happen in the case of similar requests made to our government.

### C. American Production Program.

There is general agreement here in the opinion we have formed concerning the governing principle for our American production program. That opinion is as follows:

First: The United States must first provide itself with all airplanes and engines required for training purposes in America.

Second: The United States must next provide the airplanes and engines necessary for use strictly in connection with the operation of American forces in the

field. It is best-known in Washington what will be the size and composition of the American forces in the field at any given dates in the future. You have the information as to the number and types of airplanes required in direct connection with military operations of these forces. We have learned nothing to change the views on that matter which were held by Major Foulois when we left Washington.

Third: After these first two considerations comes the American program of putting into the field next year air forces in excess of the technical requirements of its army in France. It is greatly desired that the United States shall do this. Such air forces should consist of fighting airplanes and bombers. The fighting airplanes are divided into two classes:

(a) Airplanes with fixed engines.
(b) Airplanes with rotary engines.

Both types appear to be essential. We all hold the opinion that the rotary engine is much less reliable and has much less length of service than the stationary engine; but for certain purposes it appears to be indispensable. The bombing airplanes may be divided into day and night bombers. Day bombing presents much greater difficulties than night bombing because it cannot be conducted successfully by slow machines with great bomb-carrying capacity, if the enemy have in the air any number of fast fighting machines or have great numbers of antiaircraft guns effective at great altitudes. If it should be possible to drive from the air practically all the enemy fighting machines, day bombing would become much more effective. Night bombing permits the use of large airplanes without great speed, but with great bomb-carrying capacity. There is practically no effective means of preventing night bombing. Therefore, its possibilities appear to depend almost entirely on the number of suitable airplanes which can be provided. From the military standpoint these possibilities are very great and extremely important. Could night bombing be conducted on a sufficiently great scale and kept up continuously for a sufficient time, there seems good reason to believe that it might determine the whole outcome of military operations. Up to the present time the trouble seems to have been that all bombing has been carried on intermittently and sporadically because of the lack of attention to the subject and provision for large enough numbers of the right kind of airplanes. In this connection, it may be well to compare the situation with artillery bombardment. While I speak with some diffidence on such a subject, all I have been able to learn indicates that intermittent and sporadic artillery bombardment produces but small results, notwithstanding the great size and accuracy of modern bombardment artillery. When definite and important results are desired artillery bombardment must be made systematic and continuous, and tremendous quantities of high explosives must be used on the selected objectives. This seems to be exactly the situation which exists with respect to airplane bombardment. There seems every reason to believe that it can be made of vital importance if very great numbers of airplanes carrying great size and numbers of bombs can be provided and used continuously and systematically.

To determine the proportion of airplanes of different types for United States production we have recommended the following rough method of calculation which seems to give results that check up pretty well with the views over here: first, deduct from the total number of airplanes it is considered possible to produce, the number required for use in direct connection with the military forces. That number can only be determined where it is known what will be the size of the military forces at any given time, and that number varies only in proportion to the size of the forces. By this deduction, having obtained the number of airplanes within your capacity of production which can be used independently of United States military

forces, we recommend that this number be apportioned as follows: about thirty-seven and a half percent should be fighting airplanes divided equally between fixed and rotary engine fighters; about twenty-five percent should be day bombers; and about thirty-seven and a half percent should be night bombers. Of course, it is impossible to establish any proportions which are likely to be entirely correct because it is impossible to tell what the air conditions will be at any given portion of the front at any given time. For example, the enemy may have a larger or smaller number of fast fighting machines requiring that we have a larger or smaller number of these machines and permitting our use of a smaller or larger number of day bombing machines.

### D. European Production for America.

When we left America there appeared little hope of any substantial European production to meet our needs for immediate or future use. Therefore, our production program had been considered almost entirely with respect to American production. We found the English production possibilities fully mobilized, organized, and occupied with England's very large program for next year. In France the situation is quite different. Even after three years of war French airplane and engine production possibilities appear never to have been fully investigated, analyzed, and organized. It is our opinion, shared by that of the British representatives here, that France has considerable possibilities of airplane and engine production which have not yet been developed or fully utilized. Great weight should be given to the fact that these French establishments have an experience in airplane production which is invaluable. We found the Italian production possibilities carefully investigated and well organized, but limited even more than in France by scarcity of raw and semi-finished material. In Italy however, there is a greater amount of available man-power and less need of assistance in machine tools which the Italians are now successfully making for themselves. We are, therefore, of the opinion that Italy has considerable possibilities of airplane and engine production for American needs.

In our opinion these American needs may be divided into two periods: first period, from the present time to July 1st, 1918; second period, subsequent to July 1st, 1918. With every confidence in the ultimate performance of the American production program, our investigations of production experience over here and of the sea tonnage situation have convinced us that airplanes and engines produced in America cannot be actually delivered at the front in any great quantity prior to July 1st, 1918. Subsequent to July 1st, 1918, we believe that American production will not only take care of our needs, but may become a larger factor in maintaining the air forces of our Allies. In considering the period between now and July 1, 1918, due weight must be given to the experience of all foreign countries and manufacturers in the delays in airplane and engine production which were not and could not be foreseen. Only at close hand can one appreciate how many and how great these delays have been; even if American airplanes and engines come out of our factories in quantity with comparatively few delays, consideration must at once be given to the question of how they are to be delivered in Europe. The sea tonnage situation seems to us to make it impossible to deliver here completed airplanes made in America. We think some method must be devised to assemble here the finished parts of American manufacture. This matter of assembling here is a difficult problem. We think it can be solved partly by having much of our assembling done in French plants and partly by some American assembling plants started here with French and Italian assistance. Any plan of a great American assembling plant here appears to be extremely difficult. In any event, it seems certain that quantity production of airplanes by assembly here cannot be reached prior to July 1st, 1918.

With respect to engines, the sea tonnage situation is not as bad, due to their greater facility of shipment. However, a little examination of the delays in the delivery of Army material overseas will show you how many months it will probably take to get engines from the American plants to French ports. Even after they reach the French ports there are many delays due to the condition of the French railroads, and there is no small problem ahead of us in arranging for the proper installation of the engines in great numbers at some central place where great storage capacity for airplanes awaiting engines would have to be provided.

After long and careful consideration of this subject, we and all others here have come to the very strong conviction that most of the airplanes and engines for American use at the front and for our training here between now and July 1st, 1918. must be produced either in France or Italy where effective and successful methods of production are already in full operation. Because we consider this imperative and absolutely essential to prevent failure of our air campaign next year, an arrangement has been made with the French Government under which they are to produce for us the airplanes and engines shown on the attached table, which also includes a schedule of guaranteed deliveries. Examination of the program for turning out pilots and consideration of the military plans here show that these airplanes and engines will not be adequate to the needs here, having regard to the high rate of wastage from the time they are put into service at the front and during use at the schools. I have, therefore, cabled for authority to try to obtain from Italy the additional airplanes and engines shown on the secondary table annexed hereto.

You will also find annexed a schedule of approximate prices of these airplanes and engines and a draft of the proposed agreement between the American and French Governments which is now in the final stages of execution, although the orders have been actually placed by the French Government with its manufacturers. This agreement has been prepared after conference with the Judge Advocate General and his staff here, and consideration of the arrangements under which England is having engines built in France. We believe that the United States is very fortunate in being able to make such an arrangement and that there will be a substantial saving in the cost over the cost of production in America plus overseas delivery, even if that were possible. We are obtaining these airplanes and engines at the lowest price which the French Government is able to negotiate for itself with its own manufacturers, such negotiations being now pending. The compensation of five percent paid the French Government for inspection, testing and delivery to our depots, is less than it would cost us to do this work, even if it were possible for us to organize the complicated and effective system developed by the French, which we certainly could not do.

Mr. Vail, with a staff of assistants, has spent nearly a month on a careful investigation and analysis of the requirements in machine tools and raw and semi-finished materials which are to be furnished by the United States for the production of these airplanes and engines. I cannot speak too highly of the work he has done. Without it the whole arrangement would have been impossible. He and I, Captain Marmon, and all the other members of the Commission are confident there should be no serious difficulty in the furnishing of these machine tools and materials from the United States, though it will doubtless require the exercise of the right of priority and some arrangement for the priorities of shipment. The aggregate monthly tonnages are so small that shipment should not be difficult. You will note that the arrangement contemplates the purchase of these machine tools and raw materials in the United States by the Aircraft Production Board. Judging by other war purchasing of the United States government when we left, the Aircraft Production Board will be able to insist upon reasonable prices for these machine tools and raw

materials. The French manufacturers are to furnish representatives who will advise and assist in this purchasing and the inspection. Mr. Vail and Captain Marmon will be able to give you any details not covered in this report.

### E. Types for American Production.

Our cables and the reports of Captains Clark and Marmon should furnish a full statement of our conclusions concerning types of airplanes and engines recommended for quantity production in America. In regard to these recommendations I can only add that the difficulty of deciding upon types of airplanes and engines for different purposes, particularly the difficulty of deciding for production some distance in the future, has been greater than could possibly be realized without visiting England, France, and Italy.

We have recommended the following airplanes and engines.

#### Airplanes

Advanced training Bristol Scout with 80 Le Rhone

Division or Corps d'Armee Bristol Fighter with 200 Hispano

Long Range reconnaissance and day bombing D.H. 4 with Rolls Royce or some other equivalent engine to be later adopted. (Fiat 300 has proved successful here.)

Fighting or Pursuit (fixed engine) Spad with 200 HP Hispano

Fighting or Pursuit (rotary engine) New Spad with 150 Gnome
(This airplane is now undergoing final tests)

Night bombing Caproni Triplane with 3 Isotta Fraschini 270 HP engines or other equivalent engine to be later adopted.

For very long-distance bombing with heavy loads the Italians are now arranging to use the Caproni Biplane with 3 Isotta Fraschini engines instead of the heavier Fiats now used.

For distances of 400-500 miles (out and back included) the much greater consumption of gasoline and oil by the Triplane gives it little greater bomb-carrying capacity than the Biplane with Isotta Fraschini engines, and the Biplane can be produced much more quickly and in greater quantities. It is also much easier to house at the front. For bombing at shorter distances nothing gives such great bomb-carrying capacity as the Triplane.

#### Engines

80 Le Rhone for training purposes

200 Hispano Suiza for fixed engine one-place fighters and division or Corps d'Armee airplanes

150 Gnome Monosoupape for rotary engine fighters

Rolls Royce for U.S. production only under some special arrangement of a Rolls Royce factory in U.S. This engine is not considered suitable for great quantity production. It also required very skillful mechanics to keep it in commission at the front.

While we have investigated many other excellent engines such as Renault, Fiat, Isotta Fraschini and S.P.A., all of them are too heavy per horsepower to be recommended as engines for great quantity future production in the U.S. Renault, Fiat, and Isotta Fraschini all have new designs now under test which may prove very desirable. The Bugatti engine appears perhaps to offer the most interesting future development for light weight per horsepower and case of quantity production. The developments with our U.S. engine now under test are probably the most important consideration in this question of engine production in the U.S. Of course, we are without any adequate information over here as to these developments.

### F. United States Assistance to Allies.

As indicated by our cables we fully share the view held everywhere here that the greatest and surest immediate contribution the United States can make toward the air war will be by giving every assistance possible to aid the Allies in carrying out their programs of aircraft production. They have in the field large, well-organized, well-trained, and experienced air forces which they plan to augment greatly next year. Our air forces have yet to be created, trained, and organized. While they offer perhaps the greatest eventual hope of ending the war through the air, our first duty should be to hold up the hands of those who are actually carrying on the war while we get ready to take our part. Therefore, our program of production and training should not be permitted to interfere in any way with the programs of our Allies, and every assistance possible should be given. This assistance can take three forms: first, assist in every way possible with raw and semifinished materials from the United States; second, develop as soon as possible the plan of producing in great quantity in the United States all finished parts for airplanes common to the programs of our Allies and ourselves. We believe that if this plan can be promptly and effectively established it will not only do much to relieve the problem of sea transport by reducing the tonnage of airplane material; but it will so relieve the English, French, and Italian factories of primary manufacturing operations as to permit them to increase greatly their output of finished airplanes. As indicated by my cables the British Air Board are ready to take up this plan immediately, and with vigor. The French regard it with favor and the Italians with much interest. Third, as soon as possible the United States should aid its Allies by the production in large quantities of finished engines. The engine production is even now the limiting factor in English, French, and Italian air progress. If the United States can furnish the necessary engines, all of these countries can increase their output of airplanes.

### G. Coordination of Aircraft Production.

Up to the present time there has been comparatively little coordination of aircraft production between England, France, and Italy. The entrance of the United States offers an opportunity to accomplish the coordination which is absolutely necessary and is desired by all the Allies. But if such coordination is to be established promptly and effectively it must be done over here where constant communication can be maintained with the British Air Board, the French Air Ministry, and the Italian air authority. The best possible relations have been established with them all. Any attempt to handle this matter in Washington will merely complicate the situation which must be watched daily in the light of developments which are taking place with a rapidity unequaled in any other branch of the military service.

One of the most important aspects of this matter of cooperation is the coordination of assistance to our Allies in their aircraft production. If they merely continue without our assistance their attempts to secure raw, semifinished and finished materials in the United States, hopeless confusion will follow and the situation will soon be rendered impossible for everybody. We recommend most strongly that the Aircraft Production Board take this whole matter in hand in the United States and at once ascertain and develop the sources of supply for all raw, semifinished and finished materials for airplane production, using as fully as possible the assistance of foreign representatives in America. Simultaneously, however, there should be established here some agency which will coordinate and determine priorities in necessity and importance among the demands for assistance from our Allies. Such coordination and determination of priorities can only be made here when the various military situations and programs can be quickly ascertained and the final authorities in aircraft production for the different countries can be called into conference.

## H. Aviation Personnel from America.

It is of utmost importance that adequate aviation personnel from America be sent to Europe immediately and with much greater promptness and certainty than has prevailed thus far. The British, French, and Italians have all offered to train large numbers of American aviators and mechanics. These offers afford by far the best and surest means of securing the necessary personnel of pilots and mechanics for early operations next Spring. In fact, they afford almost the only means of securing such personnel owing to the difficulties and delays in establishing the United States training schools for pilots and mechanics in France. Yet there have been hopeless delays in getting these men over here. Meanwhile the French have made all arrangements to receive them, holding open their schools, and seriously interfering with their own training programs. Right now the French have a great number of vacancies in their schools awaiting the arrival of American student pilots. In fact, only this week they had one school held idle and it is now only partially filled by the arrival of a small detachment of student aviators. The French also have had since July 10th a complete equipment ready for an American squadron and are holding it in readiness, notwithstanding its urgent need for their own squadrons. Our failure to act promptly in these matters has already occasioned the most unfortunate feeling among our Allies. If this be not remedied promptly our future efforts and relations will be very seriously endangered. My cables have indicated the needs for aviation personnel, and I strongly urge that these requests and all future requests of the same kind be more promptly complied with.

CONCLUSION. The extreme complexity and difficulty of the conditions under which our work has been done and the pressure under which this report must be prepared, leads me to ask some indulgence in its consideration. We have tried to do our best under most difficult conditions and no effort in our power has been omitted in the endeavor to do our work as well and as quickly as possible. In conclusion, I wish to express the warmest personal appreciation of the work of all the members of the party among whom there has been throughout the greatest harmony and every effort to carry out the common purpose.

Respectfully submitted,
s/ R. C. BOLLING, Maj. S.O.R.C.

### Airplanes and Engines Ordered in France

#### Training Airplanes

| | | |
|---|---|---|
| 100 Nieuport | 23 metre dual control, | 80 Le Rhone |
| 75 Nieuport | 23 metre single control, | 80 Le Rhone |
| 100 Neiuport | 18 metre single control, | 80 Le Rhone |
| 350 Nieuport | 15 metre single control, | 80 Le Rhone |
| 100 Nieuport | 15 metre single control, | 110 Le Rhone |
| 150 Spad | (or equivalent service machine) | Hispano |
| *Prices:* | Same as paid by French Government | |
| Deliveries: | In time to meet U.S. training program in France. Construction of airplanes already under way. Rebuilt airplanes from the front to be used if absolutely necessary, as done in French schools. | |
| N. B. | This order was given before training matters were put in my charge. It did not go into details, but I can arrange these. The order was absolutely necessary and has my approval. | |

### Service Airplanes

| | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *April* | *May* | *June* |
|---|---|---|---|---|---|---|---|---|
| 1500 Breguet (Renault & Fiat) | 60 | 60 | 460 | 460 | 460 | | | |
| 2000 SPAD (200 HP Hispano) | | | | 135 | 300 | 400 | 550 | 615 |
| 1500 New Spad (150 Gnome) or Nieuport (150 Gnome) | | | 50 / 300 | 100 / 400 | 200 / 400 | 300 / 400 | 350 | 500 |

Decision between New Spad and Nieuport to be made as soon as tests of New Spad are completed. There is time to await this because both types take same engine.

### Service Engines

| | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *April* | *May* | *June* |
|---|---|---|---|---|---|---|---|---|
| 1500* Renault (300 HP) | 60 | 60 | 460 | 460 | 460 | | | |
| 4000 Hispano (200 HP) | | | 135 | 375 | 565 | 755 | 945 | 1225 |
| 3000 Gnome (150 HP) | | | 400 | 400 | 400 | 600 | 600 | 600 |

*It will be necessary to secure Fiat 300 HP engines for some of the Breguet airplanes unless Renault can increase his output or deliver spares rapidly after March. The Breguet takes either Renault or Fiat. The latter can be assured if necessary.

### Airplanes Recommended for Purchase in Italy

500 S.I.A. 7 B deliveries to begin in October and be completed in December.

This is a reconnaissance and day bombing airplane similar to the engine which can also be used in the Breguet. The early deliveries offered, and inability to obtain more Breguets for early delivery, are the basis of this recommendation. Otherwise it is preferable to buy Breguets because no railroad transportation is involved. Italy offers to make these from her reserve stock December or January.

200 to 300 Caproni Biplane with the new Isotta Fraschini engine. Deliveries prior to June 30, 1918.

With this engine substituted for the heavier Fiat now used, the Caproni Biplane will carry almost the same useful load of bombs as the Caproni Triplane for long-range bombing (400-500 miles, out and back included) owing to the much greater gasoline and oil consumption of the Triplane on such long distances. The Italians say it will be impossible to build any large number of Triplanes before June 30, 1918, whereas they can deliver this substantial number of Biplanes which are extremely serviceable heavy bombers. This appears to be our only chance to obtain any number of this type of bombers before July 1, 1918.

With these airplanes it will be necessary, of course, to order an adequate supply of the Fiat and Isotta Fraschini engines, both of which have excellent records for reliability but are too heavy to be classed as engine for the future. However, it should be noted that recent tests of the D.H. 4 with the Fiat 300 HP show practically the same speed and a somewhat better climb than with the Rolls Royce engine.

# SPACE PENETRATION

By DR. E. PÉPIN, Director
Institute of International Air Law

*(Delivered at Annual Meeting, April 1958, of American Society of International Law)*

TWO YEARS AGO at the annual meeting of the Society the topic "Legal Problems of Upper Space," was discussed. This year the topic "Space Penetration" is more realistic, and I wish to congratulate the Committee of the Annual Meeting for this wording. We should abandon such a terminology as "upper space," "outer space," "upper atmosphere," as well as "territorial space" or "contiguous space" because such expressions do not correspond to any scientific or legal concept. It should be taken for granted that over and around the surface of the Earth (land or sea areas) there is what the scientists call "atmosphere," over certain parts of which national sovereignty is extended; and above the atmosphere there is "space."

The word "air space" inserted in Article 1 of the Chicago Convention is responsible for some confusion; it corresponds to the expression "espace atmospherique" or atmosphere of the Paris Convention; the word "airspace" was used in that article — and only in that article — by the Drafting Committee of the Conference, without prior discussion in any Commission, while the technicians who have drafted all the other provisions which define the rights and obligations of the Contracting States and of their aircraft have been very careful to avoid that word.

Therefore I do consider, from a legal point of view, that there are only 2 zones: one, the air or atmosphere which has a legal status already defined in an international instrument, and the other, the space of a still undefined status. I am very pleased to say that such terminology is used more and more every day.

Since the meeting of 1956 a succession of great technical achievements have been confronting the lawyers interested in space legal problems. The facts are well known and should not require an extensive exposé; however, a short chronological summary seems to me necessary.

As contributions to the activities of the International Geophysical Year (I.G.Y.), five satellites have already been placed in orbit: on the 4th of October 1957, Sputnik I; on the 3rd of November, Sputnik II; on the 31st of January 1958, Explorer I; in March 1958, successively on the 17th and 26th, Vanguard I and Explorer III. The two Sputniks have already ceased to circle the Earth and it is understood that disintegrated elements fell to the Earth but, as far as I am informed, have not yet been located. The Explorers may continue their course during several years and the Vanguard perhaps during 2 centuries.

Other satellites will certainly be launched in a more or less near future, not only by the two States which already entered into the competition, but perhaps also by other States, like Germany and Japan, which have announced such an intention.

During the same period, the launching of rockets and missiles has continued; some rockets or parts thereof have reentered into the atmosphere and have been recuperated, some containing living animals; other rockets have vanished. Missiles have arrived on or near a pre-

fixed target, but others escaped teleguidance and landed somewhere on the surface of the Earth.

It is not my purpose to detail here all the experiments and tests mentioned every day in the newspapers, nor the projects which will only be realized in a remote future.

Nevertheless, I should not omit a reference to the Report released on March 26, 1958 and prepared under the chairmanship of Prof. James Killian by the Scientific Advisory Committee to President Eisenhower who qualified it as "the most interesting and fascinating thing."

This very objective report, after reviewing what has already been done, does mention a number of problems which are still to be resolved, such as moon exploration, round trip to the moon, sending to Mars, and thereafter to Venus, instruments providing information. This report explains the enormous scientific value of the exploration of space with practical applications — among others — to meteorology, telecommunication and television. In other countries, there are also large programmes of scientific research in connection with space.

In the presence of such great perspectives for the advancement of sciences and for the greatest benefit to humanity, what should be the attitude of lawyers?

I was, and still am, of the opinion that they should not impair the scientific progress by discussing abstract legal principles; but they should try to establish, if necessary, new principles which may facilitate the task of scientists.

I will limit tonight my comments on "space penetration" to the peaceful aspects of the problem, as Mr. Bechhoefer will discuss its military aspects in speaking on "Control of Weapons;" I will consider successively:

1. What has been the attitude of the lawyers during the last two years vis-à-vis these scientific achievements and projects, and

2. What efforts have been made, and should be made, in order to find the best international solution to the problems involved and the remedies for certain consequences.

## I

Since two years a number of articles have been written and speeches delivered by lawyers, diplomats, and others on legal problems arising from the scientific achievements and projects which we have just mentioned. It is worthy of note that most of the discussions which took place since Sputnik I are still theoretical and concern only the legal status of space, and are centered either on the question of sovereignty and its extension in altitude, or on the definition of the upper limit of the atmosphere. It is surprising to see that the immediate consequences of these achievements and projects have rarely been discussed.

A. With respect to the question of sovereignty we find three groups of opinions:

(a) The most absolute opinion is a claim for sovereignty *usque ad infinitum*. That opinion which was very familiar to the lawyers prior to the First World War would hardly be reconciled with the terms of Article 1 of the Chicago Convention, where the term "air space" is synonymous of atmosphere as it is today generally agreed.

(b) Another opinion with which most of the lawyers are today in agreement is more orthodox and in conformity with the terms of the Chicago Convention; pursuant to it the sovereignty of a State is limited to the atmosphere. However, certain authors infer therefrom that the territory of a State is three-dimensional. If such a concept has its place in a general treatise of law or philosophy of law like those of Kelsen or Gugenheim, it seems difficult for commentators of the Chicago Convention to use such a formula on account of Article 2 of the Convention which expressly provides that "for the purposes of the Convention the territory of a State is deemed to be the land area and territorial waters." Naturally for this group of lawyers, space

above the atmosphere is entirely free. However, there remains the difficulty of defining the upper limit of the atmosphere.

(c) Other writers, and especially Professor Cooper, establish some transition between a zone of full sovereignty called "territorial space" and a zone of full freedom by the creation — by analogy with maritime law — of a zone called "contiguous zone," over which the sovereignty of the State is to be extended, but through which all non-military instrumentalities should enjoy a right of transit when ascending or descending. Two years ago Professor Cooper suggested that the "territorial space" should extend to the height where an aircraft as defined by the International Civil Aviation Organization may operate, and that the upper limit of contiguous zone be fixed at 300 miles above the earth surface; he extended that last limit up to 600 miles in a letter to the London Times on September 2, 1957. That arbitrary division in zones was challenged two years ago with pertinent arguments by members of the panel, Mr. Roy and Prof. Mever, and more recently in September 1957 by the well-known British authority on air law, Mr. Shawcross. Nevertheless, Professor Cooper has maintained that tripartite division, but with different definitions; in his latest address made on February 22, 1958, without giving any figure, he proposed the following definitions:

(1) Air space includes only areas where sufficient gaseous atmosphere exists to provide aerodynamic lift for such flight instrumentalities as balloons and aircraft;

(2) The intermediate area comprises the zone where the presence of a certain amount of gaseous atmosphere may cause the fall of space instrumentalities, thus endangering the State below.

B. It should be recognized that the fixation of an upper limit of a slice of space would always meet with serious objection. How would it be possible to appreciate whether an aircraft or a space craft is above or below such a limit? Even if it is now possible to determine with a certain accuracy the altitude of an aircraft, the fixation of a limit would certainly be the origin of many disputes or controversies between States.

I do not see any pertinent reason for defining the upper limit of the atmosphere or the expression "airspace." With respect to the Chicago Convention, all the rights and obligations deriving therefrom do not need the support of such a definition. Nevertheless, a tentative for defining "airspace" has been made last year in Barcelona, where the Congress of the International Astronautical Federation has established a Committee, called "Cooper Committee," composed of three lawyers and four scientists, who are entrusted with the preparation of a definition to be communicated to the United Nations and to the International Civil Aviation Organization. I was told a few days ago by the President of the Federation that the Committee never met, and that no report has been prepared up to now.

All these discussions on sovereignty, freedom, zones, bring me back to my years as student in the midst of academic discussions on aviation from 1904 to 1910. Fortunately, as I will mention later on, the first international conference on air navigation of 1910, which I have attended, avoided such sterile discussions. That is perhaps a precedent to be followed.

C. All the above-mentioned opinions expressed by distinguished lawyers, as interesting as they may be, do not necessarily represent the views of governments. Up to now there is no common legal principle accepted by all the nations of the world with respect to space.

As there is no legal international rule applicable to the circulation of space craft into space, such circulation has been considered as free. It is true that no protest has been formulated against the circulation above any State of satellites launched under the programme of the I.G.Y.; but is it possible to conclude from

that fact that all States will maintain the same views in the future, and will consider the circulation of any space craft as free? In the absence of an international agreement no legal rule may prevent a State from enacting regulations controlling or even prohibiting — if it has the means to do so — the circulation of space craft across or above its territory, thus extending unilaterally upwards the exercise of its sovereignty as no upper limits have been fixed in an international convention.

That is one of the reasons for which all the lawyers are of the opinion that a world-wide agreement, — a truly world-wide one — is necessary. A number of governments seem to be of the same opinion.

D. Before reviewing the steps already taken by governments, if the space penetration or circulation is to be considered as free from any regulation, we should give some attention to certain possible consequences of such a chaotic situation.

The persons responsible for the safe operation of civil aviation and especially of international transportation are concerned with the hazards represented by uncontrolled launchings of space craft. When ascending or descending they are passing through the atmosphere where aircraft are circulating. As improbable as it may be, some collisions may occur. It is true that the launching zones are generally considered as danger areas, and that some previous warning is generally given; but there is no international rule thereon, and certain aircraft already in flight may not have been informed.

More persons are concerned with damages on the surface which may be caused outside the launching country by a space craft returning to Earth, either on a safe return or after partial disintegration, or by a space craft which fails during launching or escapes teleguidance. The question of compensation should be settled.

In cases of collision or damages, it would be necessary to be able to identify the space craft responsible. If in the near future that would be probably easy, practical measures will be absolutely indispensable when dozens or hundreds of space craft will circulate around the Earth.

Another consequence is the possible interferences which may be caused to radio communications in general by the frequencies used by space craft. It is true that the frequencies used by the satellites which have been and are still in orbit have not interfered with other frequencies; but, if a number of space craft were circulating, perhaps with an equipment more powerful, the danger of harmful interference would increase. With sun batteries the emission may continue perhaps for years unless it can be stopped by a remote electronic device; it is also possible that the equipment may come off frequency and therefore cause unexpected and detrimental interference with other frequencies, like those allocated to aviation safety communications. Here also some regulation is necessary.

Certain projects, such as the one formulated in Barcelona concerning the launching of an H-Bomb to explode on the Moon, would involve greater danger for humanity; such explosion may, as it was mentioned by various scientists, disturb the celestial relationship between the Moon and the Earth; the advisory Committee to the President has also expressed, in its recent Report, its concern with such project.

There are a number of other consequences deriving from space penetration, and I am naturally aware of possible strategic or military consequences on which Mr. Bechhoefer will speak.

In the future other problems will need consideration, e.g., when some satellite platform is to be established in space, or when an exploration team will land on the Moon or on a planet. But such problems concern the occupancy of the Space, and the Society will certainly devote another meeting to their study.

## II

The practical examples just mentioned demonstrate the necessity of establishing,

in the immediate future, some international regulatory authority. We will consider now the steps already taken by international organizations or governments to such effect.

An attempt was made, as early as June 1956 at the 10th session of the Assembly of the International Civil Aviation Organization. In a Report approved by the Assembly the Legal Commission pointed out that the problems of space fell essentially within the functions of the Organization, and that at a suitable time, they might be included in the framework programme of its Legal Committee. Unfortunately no further steps have been taken. After the launching of the two Sputniks another attempt was made to call the attention of the Representatives on the ICAO Council to the urgency of considering these problems; but, upon instructions, these Representatives considered such action as premature.

In the United Nations, the problems of space have been up to now related more or less to questions of disarmament. A proposal was made in July 1957 before the Subcommittee of the Disarmament Commission meeting in London. One week after the launching of Sputnik I, another proposal was introduced by 21 States before the General Assembly of the United Nations which adopted, on November 14, a resolution urging the States to give priority to the consideration of a disarmament agreement which would provide for "a joint study of an inspection system designed to insure that the sending of objects through outer space shall be exclusively for peaceful and scientific purposes."

In January 1958, before the General Assembly, the Representative of the United States stressed the necessity of assuring the development in space exclusively for peaceful and scientific purposes. President Eisenhower, in his letter dated January 13, 1958 sent to the Chairman of the Council of Ministers of the Soviet Union, said: "I propose that we agree that outer space should be used only for peaceful purposes."

A more concrete proposal, but mixed with other proposals of a political and military character, was expressed on March 15, 1958 in the following statement of the Soviet Foreign Minister: "In the interest of developing international cooperation in peaceful cosmic space research the establishment within the framework of the United Nations of an agency for international cooperation in the study of cosmic space with the following functions:

(1) to work out a great international programme for launching intercontinental and space rockets with the aim of studying cosmic space and supervising the implementation of the programme;

(2) to continue on a permanent basis the research space now being carried on within the framework of the I.G.Y.;

(3) to serve as a world centre for the collection, mutual exchange, and dissemination of information of space research;

(4) to coordinate national research programmes for the study of cosmic space, and render all-around assistance through their realization."

The proposal of establishing a specialized agency is in line with the proposals made many times during the last few months by the President of the General Assembly of the United Nations, Ambassador Munro.

Such an establishment should be discussed either within the organs of the United Nations, or preferably by a special Conference convened by the United Nations. I do hope that priority be given to the consideration of practical problems, such as those which we have mentioned previously, without discussing abstract principles. May I recall here the method followed by two international conferences which met at the time of the first controversies between sovereignty in space and freedom of space. At the Berlin Conference of 1906 on wireless telegraphy, the plenipotentiaries decided not to discuss any abstract declaration concerning property rights over the

space; and at the first Paris Conference of 1910 on air navigation, delegations agreed unanimously not to discuss theoretical problems like the legal status of the air space, but to concentrate their discussions on the use of that space in order to promote and facilitate air navigation, at that time in its infancy. The draft convention, which for other reasons was never finalized, was an excellent set of provisions without any declaration of principles.

If such a space agency is established, it would necessarily work in close cooperation with other specialized agencies, like the International Civil Aviation Organization which has a great experience on air regulation and problems of safety, and the International Telecommunication Union which is responsible for allocation of frequencies and may assist in the avoidance of interferences.

* * *

In concluding these remarks, I wish to cite the following words published in the early days of aviation in 1910, in the Journal of the Society, under the signature of one of its founders, Mr. Arthur Kuhn. After mentioning the pessimism of Prof. Simon Newcomb, who expressed in 1908 — just fifty years ago — his doubt "whether the time would ever arrive when passengers could be conducted through the air in safety and comfort upon a machine that can be available at will," Mr. Kuhn said: "Though the degree of usefulness of air navigation may still be in doubt, all must admit that a new medium of internal as well as international intercourse and traffic has entered the life of man. Assuming but little advance over the present state of the art, air traffic in some of the forms already known to us will not be merely occasional, but frequent. As with all other advances in material science of a world-wide and permanent character, new relationships between states and individuals are imminent, and to adjust and control them in an orderly manner is the task of governments through law."

On the eve of the space age, we should build a law of space.

Whosoever does not know how to recognize the faults of great men is incapable of estimating their perfections.

—VOLTAIRE

* * * *

Money and time are the heaviest burdens of life, and the unhappiest of all mortals are those who have more of either than they know how to use.

—SAMUEL JOHNSON

* * * *

The man who does things makes many mistakes but he never makes the biggest mistake of all—doing nothing.

—POOR RICHARD

# TOMORROW'S HISTORYMAKERS

## A MESSAGE TO YOUNG OFFICERS . . .

By LT. COLONEL RUSSELL P. STRANGE, USAF
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Directorate of Military Personnel
Headquarters USAF

TENNYSON'S thought in his *Mort d'Arthur* has given to us unknowingly our philosophical outlook on change: "The old order changeth, yielding place to new."

Change in the civilization of our century has been as dazzling and as fundamental as that which took place in the age of the Renaissance. Consider Descarte's analytic geometry and scientific methods, Galileo's experimental science and mathematics, Newton's physics, Grotius' law; or even earlier in Ancient Greece, Socrates, Plato, and Aristotle ordering the universe for the mind of man to accommodate the growing civilization. The impact of physical science on our time is even more vivid due to the compression of time. The magic has been performed before our eyes.

Less apparent, however, are the new imperatives of command and leadership which tomorrow's ordering of the universe requires. For the Air Force, with its military mission and its space challenge, a blue suit capability of leadership is vital to give direction and purpose to science and engineering in the service of the nation.

Of course, there are various kinds of blue suit leadership required. One kind would be an "in-house" capability of applied scientific research for military and space purposes. Another is the operational capacity of employing missiles and space vehicles. But the essential precondition for these two kinds of capability is basic command and leadership qualities.

If the Air Force is to develop this leadership for the new challenge, the characteristics of individual officers in the corps must be changed. In addition to the customary attributes of being an officer, there is imposed a new demand—that of an intellectual understanding of the forces of science which are to be employed to accomplish the mission. This intellect, again, is but a new instrument to be used in the old art of command.

Relentlessly and inevitably, the hands of today's commanders will turn over the controls to you, the young officers of today. This relinquishment will always be with a sense of reluctance, but it need not be with a sense of fear for the future. The turnover of the controls can be with full confidence and a feeling of satisfaction, if you gentlemen respond to the real and dramatic challenge before you as officers in the space age Air Force.

Your task, then, is to ready yourself for taking over the controls—to be able to read the instrument panel of today's Air Force, and to see beyond it for the true direction and meaning of what is taking place. Only then can you accurately lead the Air Force into tomorrow. You are the link between the realities of today and the invisible challenge of tomorrow. You will begin where the commanders of yesterday and today leave off.

This is history in its fullest sense and you are the historymakers.

How do you meet the challenge? First, you must realize that you must use your intellect, your skill, and your mind in carrying forward the role of mission accomplishment. You must discipline yourself and be responsive to the discipline of your commanders. You must realize that in doing these tasks and making your unique contribution, you are doing three things: (1) Doing the job to be done here and now; (2) Creating those things to be used in the future; (3) Understanding that all of these tasks are but preparation of yourself for ever higher positions and responsibilities.

How do you acquire the intellectual qualities for tomorrow's command? You do this by developing your mind in an orderly and systematic manner either on your own or, more readily, through higher education. In recognition of the demands placed upon you, the Air Force sends hundreds, even thousands, of young officers to the universities of this nation to develop their intellectual capabilities. Realizing this, you should carefully monitor your own career, making sure that you gain experience on the job for two or three years, and then advance your education to the graduate level, and repeat this process in developing and programming toward higher levels of staff and command.

Your next move then is to get the facts about the assignments and the universities from your personnel officer, and then to phase an educational period into your career. This should be done a reasonable time in advance of your planned university entry date.

In summary, you are urged to prepare yourself for the future Air Force by means of scientific and engineering education, because this is a necessary instrument for you to possess for your future success and the future success of the Air Force. You should realize that success is measured in terms of promotion and your own satisfaction of seeing the results of your new technical and intellectual abilities advance the readiness of the Air Force and the Nation. Promotions and other rewards in the Air Force have always gone to those who carry the primary mission load. Consequently, the bulk of future promotions will go to those who are carrying the space age mission load. The same is true of prestige. The mystery of science, the awesomeness of the missile, and the challenge of space are already hammered into a badge of honor for the officer engaged in science and engineering, either in the laboratory, in development, in operations, or in command. You should understand your challenge because you cannot escape it. You are tomorrow's historymakers.

* * * *

A principle of policy once established, be it sound or unsound, is almost sure, through evolution, to exert an influence far beyond that created at the time of its original inception.

—ALFRED P. SLOAN, JR.

* * * *

If we open a quarrel between the past and the present, we shall find that we have lost the future.

—WINSTON CHURCHILL

* * * *

Liberty means responsibility. That is why most men dread it.

—GEORGE BERNARD SHAW

* * * *

The most essential feature of man is his improvableness.

—JOHN FISKE

# THE FIRST MANNED FLIGHT

By LIDA MAYO
Chief Historian, Ordnance Corps, U. S. Army

ON AN undetermined day in late 1852 or early 1853, the first aviator soared into the air from a hillside near the coast of Yorkshire in England. His name is lost to history. All that we know about him is that he was a coachman in the employ of Sir George Cayley, the scholarly Yorkshire baronet whom the world's leading air historians now call the true inventor of the airplane.

Until Charles Dollfus, J. E. Hodgson, J. Lawrence Pritchard, and Charles H. Gibbs-Smith recognized Sir George as the father of modern aeronautics, and the obscure coachman as the first aviator, historians supposed that Capt. Jean-Marie Le Bris, a Frenchman who made a short soaring flight in a fixed-wing glider in 1857, was the first man to fly in heavier-than-air craft, and that Otto Lilienthal, a German who began his gliding and soaring experiments in 1891, was the first man to pilot such a craft.

Lilienthal's influence was particularly great because of the age he lived in. By the 1890's, world-wide dissemination of his achievements became possible through newspaper and magazine articles containing excellent photographs of his flight.[1] The results of Sir George Cayley's experiments appeared only in the English scientific periodicals of his day, and there were no photographs. The specifications of the machine that took the coachman up were generally unknown until recently, when Gibbs-Smith came upon a drawing in the 25 September 1852 issue of *Mechanics Magazine*, under the misleading title "Governable Parachutes," and reproduced it in the London *Times*.[2]

The airplane was, of course, a glider; powered manned flight of heavier-than-air craft had to await the invention of a workable engine fifty years later. It was also a monoplane. To a kite-shaped wing with a tailpiece, the whole about five hundred square feet, was fixed by struts to an open boat-shaped car for the pilot, with a tail-unit hinged at the rear. The purpose of the wing's tailpiece (a combined fin and tailplane) was to provide stability in flight. Slightly elevated and secured by wires to the car, it would help to keep the craft from pitching in an eddy of wind. The purpose of the car's tail-unit (a combined rudder and elevator) was to provide control in the air. The pilot worked it by a tiller. The all-up weight was about three hundred pounds.[3]

This remarkable machine was the fruit of more than fifty years of study and experimentation in aeronautics by Sir George Cayley, who at the time of the coachman's flight was an old gentleman nearing eighty, with white hair, white side-whiskers, a big nose, and small keen eyes.[4] He was one of those cultivated country gentlemen of the late eighteenth and early nineteenth centuries who were passionately interested in science and often made significant contributions. Thomas Jefferson was one of them; another was William Henry Fox Talbot in England, who invented photography independently of Daguerre.

Another characteristic of these distinguished amateurs was the wide range of their scientific interests. At his estate, Brompton Hall near Scarborough, Sir

Fig. 1

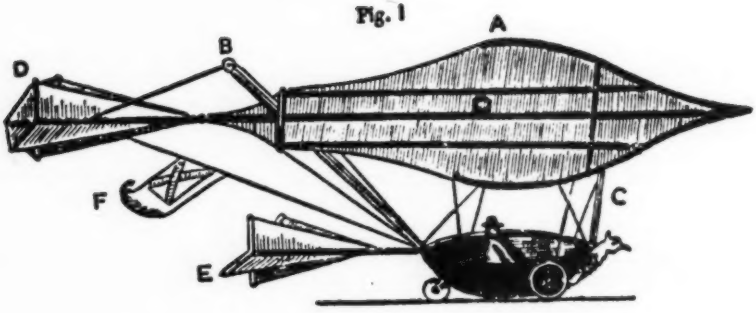
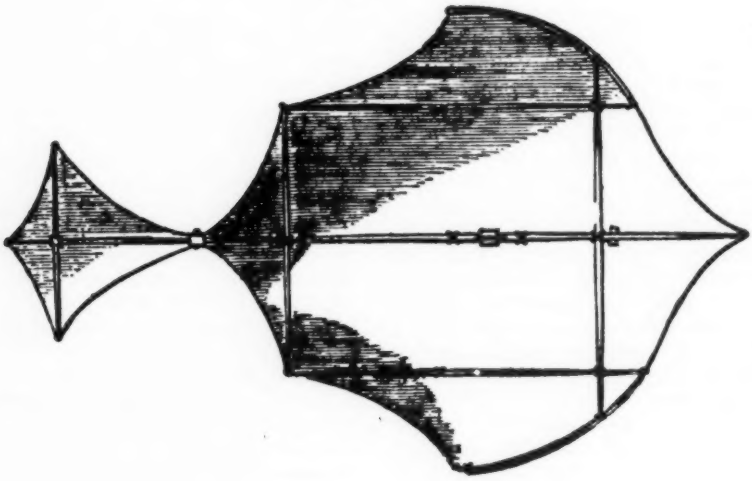



Fig. 2



## DRAWING OF THE FIRST MANNED AIRPLANE

*Fig. 1. Wing (A) is fixed by struts (B) and (C) to car, which has tail-unit (E) and tricycle undercarriage. Tailpiece (D) after adjustment is fixed by wires passing to car, one by eye at top of strut (B), the other below, from which hangs a flag (F).*

*Fig. 2. The plan-view of the airplane, shows device at center for attachment to balloon.*

*From reproduction by Charles H. Gibbs-Smith in London Times, 13 June 1960, taken from wood-engraving in Mechanics Magazine, 25 September 1852.*

George had been experimenting with one thing or another all his life. He was a born mechanic, born with long, beautifully shaped, and very dextrous hands. As a boy he spent most of his time hanging around the village watchmaker, and when he grew up he built his own workshop at Brompton Hall.[5] There he experimented with railway safety devices, self-righting lifeboats, rifled gunshot, artificial limbs, and engines worked by hot air or gunpowder; and invented the caterpillar tractor and the tension wheel, which he specifically stated was the most suitable wheel for aircraft undercarriages.

His earliest and strongest interest was in finding some vehicle for navigating the air—that "uninterrupted ocean," he called it, "that comes to the threshold of every man's door."

Ascent into the airy ocean became possible after Montgolfier invented the balloon in 1783, when Cayley was ten years old. But the balloon could not be navigated in any real sense; to go in any desired direction, the aeronaut had to depend on finding an altitude where the air currents were helpful. Therefore, except for the brief use of tethered balloons for military reconnaissance, and an unsuccessful attempt by the Austrians to bomb Venice with small balloons carrying time-fuzed bombs, the balloon in Cayley's lifetime was flown chiefly for adventure and entertainment.

Cayley's practical mind thought of the balloon in another role—as a means of getting the airplane into the air. For that reason, his 1852 glider had a device on the top of its wing that would enable it to be attached to the gondola of a balloon. This accounts for the misleading name, "governable parachute."[6] In describing his glider, he made this prophetic statement: "It need scarcely be further remarked, that were we in possession of a sufficiently light first mover to propel such vehicles by waftage, either on the screw principle or otherwise, with such power as to supply that force horizontally, which gravitation here supplies in the descent, mechanical aerial navigation would be at our command without further delay."[7]

Unable to apply any of his own engine work to aeronautics, he lacked his "light first mover," but he understood the principles of aerial navigation at a very early date. By 1799 he had realized that the whole problem of heavier-than-air flight was, in his own words, "to make a surface support a given weight by the application of power to the resistance of the air." He was not deluded by the ornithopter, or wing-flapping principle, on which so many hopes of flight were wrecked. He was a pioneer in the fixed-wing principle, and advocated the cambered, or curved wing, as providing more lift than a flat one. In 1799 he scratched on a silver disc, now in the Science Museum in London, a design for a monoplane glider on these principles, with a cockpit for a man, a combined fin and tailplane, and two rear flappers to be manually operated.

He made his first model in 1804. It consisted of an ordinary kite fixed at a six-degree angle of incidence to a pole that had at the other end a combined fin and tailplane attached by a universal joint that could be moved in any direction to guide the craft up or down, and to either side—a device that antedated Alphonse Pénaud's by seventy years. Of this model, which Gibbs-Smith calls the first proper airplane of history, Cayley wrote: "It was very pretty to see it sail down a steep hill, and it gave the idea that a large instrument would be a better and safer conveyance down the Alps than even a sure-footed mule."

Continuing his experiments along these lines, by 1809 he had constructed a glider with a surface of three hundred square feet that weighed 56 pounds, and was therefore capable of carrying a load of 84 pounds, on the basis of about one pound to every two square feet of surface. Not wishing to hazard a human life until the machine had been thoroughly tested, he experimented with dead weights,[8] launching the craft from a hilltop into a valley, and was perfectly satisfied as to its steer-

age and steadiness. "It was beautiful," he wrote, "to see this noble white bird sail majestically from the top of a hill to any given point of the plain below it with perfect steadiness and safety, according to the set of its rudder, merely by its own weight descending in an angle of about 8 degrees with the horizon."[9]

Unfortunately, the machine was accidentally broken before he could launch it with a human being aboard, though it appears that he was still able to test it as a "hang glider" of the type used by Lilienthal, in which the body hangs suspended from the central frame of the machine. A statement by Cayley that he had succeeded in floating a ten-year-old boy (who would presumably weight 84 pounds or less) for several yards may refer to a hang-glider experiment with the 1809 model, for after the accident Cayley wrote: "Even in this state, when any person ran forward in it with his full speed, taking advantage of a gentle breeze in front, it would bear upward so strongly as scarcely to allow him to touch the ground, and would frequently lift him up and convey him several yards together."[10]

More than forty years were to pass before he was ready to send up a man. They were busy years. He had a large family; having married at 19 the only daughter of his former tutor, the Rev. George Walker, he fathered ten children. He served for a short period as Whig Member of Parliament for Scarborough; and travelled extensively on the continent, where he formed friendships with such men as Arago and Baron de Ferussac. He made friends easily, for he was a charming man with a keen sense of humor and many interests outside his workshop. A descendant described him as "a perfect walking dictionary on all subjects." He was an expert at conjuring tricks, fencing, and fly-fishing.[11]

These pleasant pursuits never interfered with his serious study of aeronautics. He published designs for dirigibles, which he called "navigable balloons," to be driven either by propellers or flappers;

*Silver disc with a design for a man-carrying monoplane, initialled and dated by Cayley. From Charles H. Gibbs-Smith's History of Flying.*

and in 1843 made a model of a remarkable little machine with four helicopter screws, two on either side of the fuselage. a tailplane for fore-and-aft control, and two pusher propellers at the stern. That same year he made a careful study of W. S. Henson's drawing for a steam-powered monoplane, the *Ariel,* correctly concluding that Henson's engine could not provide the very great engine power that the design required. And throughout these years he continued his experiments with his full-scale gliders.[12]

By the end of 1852 he was ready for a manned flight. On the historic day, his family and servants gathered on a hillside at Brompton Hall to watch the launching, the ladies clutching their bonnets and subduing their hoopskirts against the breeze blowing in from the Yorkshire coast. A granddaughter remembered later that the coachman had no enthusiasm for his role, but he climbed obediently into the cockpit, and the machine took off from the hillside, flew across a little valley about three hundred yards wide, and landed on the opposite hill at about the same level.[13] After the

landing, according to family tradition, the coachman walked up to Cayley and in the broadest Yorkshire dialect said: "Please, Sir George, I wish to give notice. I was hired to drive, not to fly!"[14]

Whatever the coachman's feelings, the experiment undoubtedly confirmed Sir George in his conviction that "this noble art of flying will soon be brought home to man's general convenience, and that we shall be able to transport ourselves and our families, and their goods and chattels, more securely by air than by water, and with a velocity of from 20 to 100 miles per hour." From that moment he prophesied, "a new era in society will commence."

FOOTNOTES

[1]Charles H. Gibbs-Smith, *A History of Flying* (London, B. T. Batsford: 1953), p. 197. Unless otherwise noted, the sources for this article are found in this volume.

[2]Charles H. Gibbs-Smith, "First Manned Aeroplane," *The Times*, 13 June 1960.

[3]*Ibid.*

[4]See engraving in J. E. Hodgson, *The History of Aeronautics in Great Britain* (London, Oxford University Press: 1924), fig. 134, opp. p. 346.

[5]J. E. Hodgson, introduction to *Aeronautical and Miscellaneous Note-Book (ca 1799-1826) of Sir George Cayley* (Published for the Newcomen Society: 1933), pp. x-xi.

[6]"Sir George Cayley's Governable Parachutes," *Mechanics Magazine*, Vol 57, No. 1520 (25 September 1852), pp. 241-44.

[7]*Ibid.*, p. 244.

[8]*Ibid.*, p. 243.

[9]Sir George Cayley, *Aerial Navigation* (Aeronautical Classics No. 1: 1910), pp. 11, 20.

[10]*Ibid.*, p. 20.

[11]J. E. Hodgson, introduction to *Aeronautical and Miscellaneous Note-Book. . . .*, p. xii.

[12]A list of Cayley's papers down to 1826 refers to manuscript letters 1817-24 in which Cayley describes his experiments with "aeroplanes" or "gliders" constructed of bamboo cane and cloth. *Aeronautical and Miscellaneous Note-Book. . . .*, p. 82.

[13]Charles H. Gibbs-Smith, "First Manned Aeroplane."

[14]J. E. Hodgson, *"The History of Aeronautics in Great Britain*, p. 346.

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## AN EXCERPT FROM UNITED STATES STRATEGIC BOMBING SURVEY (European War)

Allied air power was decisive in the war in Western Europe. Hindsight inevitably suggests that it might have been employed differently or better in some respects. Nevertheless, it was decisive. In the air, its victory was complete. At sea, its contribution, combined with naval power, brought an end to the enemy's greatest naval threat — the U-boat; on land, it helped turn the tide overwhelmingly in favor of Allied ground forces. Its power and superiority made possible the success of the invasion. It brought the economy which sustained the enemy's armed forces to virtual collapse, although the full effects of this collapse had not reached the enemy's front lines when they were overrun by Allied forces. It brought home to the German people the full impact of modern war with all its horror and suffering. Its imprint on the German nation will be lasting.

* * * *

Public education is a great instrument of social change. Through it, if we so desire, we can make our country more nearly a democracy without classes. . . . Education is a social process, perhaps the most important process in determining the future of our country; it should command a far larger portion of our national income that it does today.

DR. JAMES B. CONANT

# ENDORSEMENT by the CHIEF of STAFF---

DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF STAFF
UNITED STATES AIR FORCE
WASHINGTON, D.C.

SUBJECT: The Air Force Historical Foundation

TO: Members of the United States Air Force

1. In 1953 General Vandenberg sponsored the formation of The Air Force Historical Foundation. He was undoubtedly motivated by the obligation all dedicated men hold for the future. I reaffirm our determination to preserve the memories, the victories, and the frustrations of the past in order that future generations may derive a profit from our experience

2. The Air Force Historical Foundation, by preserving the annals of American airpower, is making a notable contribution that will increase in significance with the passing of time. The airpower story is treated informally and interestingly in The Airpower Historian, published quarterly by the Foundation. I consider it pre-eminent in its field.

3. The Foundation is organized primarily for the Air Force and deserves our support. My association with it through the years has been most rewarding and I recommend it highly to all men and women who have served or are now serving with the United States Air Force.

THOMAS D. WHITE
Chief of Staff

# *A REPORT FROM THE PRESIDENT*

1 October 1960

SUBJECT: Response to a Challenge

TO: The Members of The Air Force Historical Foundation

As a preface to this letter, may I invite the attention of all members of The Air Force Historical Foundation to the letter from the Chief of the Air Staff which is carried in this issue of *The Airpower Historian.* This letter needs no amplification on my part. However, my own letter, which was carried in the July issue, I feel should be expanded in order that each member of the Foundation may be more fully informed on the purpose and objectives of the Foundation and the things that need to be done to give fulfillment to those aims.

Since 1953, The Air Force Historical Foundation has been continuously sponsored and, within the bounds of official regulations, supported by all Chiefs of the Air Staff. Due to manpower and other restrictions the Air Staff, in October 1959, was compelled to withdraw its personnel support of the administrative staff of the Foundation. This action I fully endorsed and made my views known to the Chief of the Air Staff.

However, the withdrawal of Air Force personnel support created a critical situation, especially in connection with the future publication of *The Airpower Historian.* Therefore, at a special meeting of our Executive Committee at Bolling Air Force Base on 23 November 1959, it was decided to put on an intensive Joint Air Force-Foundation campaign for new members in order to overcome the effects of the loss of Air Force personnel support; this intensive membership campaign to be carried on, beginning in July 1960 and throughout 1961.

Personally, I was not satisfied with the opening date set for the campaign. I, therefore, asked the Chief of the Air Staff to give me authority to visit, by air, all major Air Force bases, both overseas and at home, and get the campaign under way without any unnecessary delay. I elected to launch the campaign in the Pacific Air Forces area. My request to carry out this plan was approved by the Chief of the Air Staff and a letter of instructions to all major commands, dated 13 April 1960, was subsequently issued.

My journey by air to the Far East started at Bolling Air Force Base on 19 April 1960, via Alaska, Japan, Okinawa, Philippines, Hawaii, and ended at Andrews Air Force Base on 29 May 1960.

The activities carried on in the Far East, by personal contact with the men and women of the Pacific Air Forces, may be set forth as follows:

1. Overseas areas visited: Japan, Okinawa, Philippines, Hawaii.
2. Nautical miles travelled: Approximately 18,000.
3. Number of Air Force Bases visited: 14.
4. Number of Wives Clubs organized to conduct the campaign: Japan 10; Okinawa 6; Philippines 2; Hawaii 4; Total 22.
5. Number of Project Officers selected: 8.
6. Number of formal talks to men and women of the Air Force: Approx. 50
7. Number of informal talks to men and women of the Air Force: Approx. 100.
8. Number of TV appearances and Press interviews: 24.

From the Commanding General of the Pacific Air Forces down through the

chain of command to the Pilots and Airmen on the Front Line, my staff and myself were given a most wonderful reception, and their response to the membership campaign was openly enthusiastic.

The Wives Clubs turned out in force at every Major Base which we visited, and were very very receptive to the proposal that they conduct local membership campaigns. And all the women, especially those with children of school age, were deeply interested in *The Airpower Historian* and its potential value as an educational aid to children of school age.

Upon my return from the Far East I learned that, during my absence, a meeting of the Foundation's Board of Trustees and of the Foundation's membership, to review the affairs of the Foundation, was scheduled to take place at Bolling Air Force Base on 28 June 1960. This afforded me time and opportunity to prepare a report on the Far East tour of the Pacific Air Forces, and also an opportunity to submit a few recommendations regarding future Ways and Means to be employed in expanding the membership of the Foundation. In the preparation of my report I found it necessary to examine the Foundation's records regarding the status of our present-day membership.

This examination disclosed a disturbing situation in the response of a great number of our members to the payment of annual dues, which is the major source of income for keeping the Foundation operationally healthy. I feel obligated to bring this critical situation into the open with full confidence that appropriate response will quickly improve it. The situation may best be shown with the statistical statement that follows:

*Status of Delinquent Accounts*

| *Years* | *Number* | *Dollar Value* |
|---|---|---|
| 6 | 591 | $10,638.00 |
| 5 | 51 | 765.00 |
| 4 | 145 | 1,740.00 |
| 3 | 177 | 1,593.00 |
| 2 | 346 | 2,076.00 |
| Totals | 1,310 | $16,812.00 |

In the matter of annual dues, it should now be generally understood that membership in The Air Force Historical Foundation carries an obligation for dues in the amount of $3.00 annually, or $10.00 for four years, until the date of written resignation. In the early drive for members it is very probable that this fact was not made sufficiently clear to some new members. This is my impelling reason for treating with the subject here, as we are reluctant to remove a member from the roster until he states it as his wish.

At the Annual Meeting of the Foundation I made the following recommendations, which were approved:

1. That, during the remaining months of 1960, every member present *recruit at least 1 new member;* either by *donation* of a *Gift* Membership or by *personal* sales talk.
2. That, during the remaining months of 1960, every member present *contact other members of the Foundation,* and urge them to recruit at least 1 new member, either by *Gift* Membership or by *personal* sales talk.
3. That, if the July issue of *The Airpower Historian* has not as yet gone to the printer, the Executive Director of the Foundation be directed to insert in that issue a *similar appeal* to *every member* of the Foundation now on the mailing list.

4. And, to *continue* this *Appeal* to *every member* of the Foundation throughout the year 1961!

As one of the four living men in the Air Force, who have devoted over half a century to military aeronautics, I may state that for the past 52 years, my *one* major objective has always been *NATIONAL MILITARY SECURITY* and, in the past, I have frequently been called upon to make substantial *financial contributions* in the interest of this cause.

Today I visualize the Objectives and Aims of The Air Force Historical Foundation as being of vital importance to the present-day U. S. Air Force; especially in connection with such vital military factors as *Morale, Leadership,* and *Citizenship.*

Today I visualize the U. S. Air Force as the major guardian of our National Military Security, and I am extremely loathe to believe that there are many members of the Foundation who are not inclined to support its objectives and aims through active participation. I believe that membership attitude in general is similar to my own.

As President of the Foundation, I have dedicated my services to its objectives and aims, and although now past 80, I expect to continue with my policy of making Annual *Financial Donations* to the Foundation as freely as I can afford.

In our 1960-1961 campaign for new members, I list below the financial donations which I have made to the Foundation since December 1959:

1. Number of Gift Memberships donated — 70 ..... Cost—$210.00
2. Room, Board, and Entertainment Expenses (Far East Tour) ..... 540.00
3. Total Cash Donations to Foundation since December 1959 ..... $750.00

Since July 1960, I have continued to visit and organize the Wives Clubs within one day's flying distance from Andrews Air Force Base. This practice I plan to continue through the remaining months of 1960 and 1961.

I have also continued my *Gift* Memberships to Major Command Project Officers, Base Project Officers, and to the Presidents of Wives Clubs at each Base which I have been able to visit. This policy I propose to follow throughout the remaining months of 1960 and 1961.

In my four recommendations as approved at the 28 June 1960 meeting, I have proposed that each active member endeavor to recruit at least one new member, either by donation of a *Gift* Membership, or by *personal* sales talk. This, in my opinion, is a minimum contribution which I believe every individual member of the Foundation can easily afford.

As to those members of the Foundation who can afford to make larger contributions, and I have no doubt that there are many who can do so, I recommend that you entertain the proposition of converting from Annual to one of the higher membership categories. Every change will contribute directly in overcoming the temporarily adverse condition created by the loss of Air Force personnel support.

And, finally, may I also appeal to the 1,310 members, whose names now appear in the Foundation's records as "delinquent" in the payment of annual dues. Whatever their reasons may be, I earnestly hope that they will take steps to have their names removed from the delinquent list, and thereby take an active part in maintaining healthy features in our institution.

Sincerely,

/s/ B. D. Foulois
B. D. FOULOIS
Major General, USAF (Ret)
President, AFHF

# LETTERS TO EDITOR . . .

Dear General Anderson:

Many thanks for your kind letter of September 22nd in which you informed that my gift membership for Fred L. Thomas of 1051 Myrtle Ave., Brooklyn, N. Y., has been promulgated. I am happy to enclose a check for three dollas to cover payment.

The Foundation's magazine, *The Airpower Historian*, continues to be one of the outstanding publications of its kind that I have seen anywhere, and I do see many publications each month. Despite my extremely busy schedule, I always look forward to some enjoyable and interesting reading when my *Airpower Historian* arrives in the mail.

I would like to see all young college students in the Air Force ROTC become members of The Air Force Historical Foundation. Perhaps a plan can be arranged, similar to the Air Force Association's cadet membership, so that these students can be attracted to the organization. Indeed, they are missing so much by not becoming members.

With warm regard,

Faithfully yours,
IRVING P. SCHWARTZ
Board of Education
City of New York

Dear General Anderson:

Time once again for a Charter member to renew membership and assurance of receiving your most interesting publication.

I also wish at this time to apply for membership for my son, a cadet fourthclassman, at the Air Force Academy. It is my belief that *now* is the time to continue to foster his interest in the Air Force and its glorious history.

Too, as you probably know, the life of a lowerclass "Doolie" is sometimes discouraging, to say the least. I hope *The Airpower Historian* may in some measure be of academic and morale assistance. If you would have a *spare* moment, one of your delightful short notes would be welcomed by him, I am sure.

Thank you.

Sincerely,
JAMES I. WHEELER
Major, USAF

Dear General Anderson:

Enclosed is my membership check for the Historical Foundation. I enjoy the articles and studies in the magazine greatly. They are not only interesting to me as a reservist and former active duty officer but in my civilian profession as well — social studies instructor.

I congratulate you on the high quality of the magazine and am looking forward to the next edition.

Sincerely yours,
GEORGE E. FRAKES
First Lieutenant, AFRes

Circulation Manager:

For seven years you have demonstrated your good faith in me as a Charter member of your Foundation.

The enclosed personal check in the amount of $21.00 is forwarded to cover 7 years back subscription and to show that you have won my heart.

It will be a privilege to demonstrate *my* good faith toward the Foundation in the remaining years of my life.

NAME WITHHELD
Major, USAF

Dear General Anderson:

Enclosed is my check for $3.00 to cover annual dues.

My colleagues in the Air National Guard and I have been particularly impressed by the recent articles, "The Battle for Men's Minds," by Dr. Thomas F. Staton. You may assume correctly that my copies of *The Airpower Historian* get wide distribution here at Barnes Airport.

Sincerely,
GEORGE C. McCLEARY
Major, USAF

# Airpower Book Review

NUCLEAR FLIGHT, edited by Lt. Colonel Kenneth F. Gantz, USAF: Duell, Sloan & Pearce, Inc., New York, 1960, $4.00.

Technology is compounding the complexity of both vehicles and weapons, and expanding the demand that the professional military man keep his comprehensions abreast with these changes. It is an energy and time-consuming obligation, but if professional competence is to be maintained, the cost must be paid.

*Nuclear Flight* treats with the elementary principles of nuclear physics as they relate to military vehicles and weapons in a manner that can be readily understood by the layman. It discloses very clearly the advances we have already made, where we seem to be headed, and the obstacles that are deterring progress.

This book is another addition to the ever-growing list of publications that the professional Air Force officer should read if he would maintain an adequate competence to employ new weapons and equipment as they reach the production line.

O.A.A.

SEARCH IN THE NORTH, by Guy Blanchet: St. Martin's Press, New York, 1960, $4.50.

This is a story of the machine pioneering in the wilderness. It is concerned with the men, and their planes, who explored new frontiers and cut new trails—air trails—where only the sled and canoe had gone before.

It is a recounting of the experiences of a group of visionary men who, in 1928, were the first to attempt mineral prospecting by airplane in the Arctic Barrens. However, the commercial aspects and details of prospecting are minimized and the story evolves about the Arctic, the problems, the challenge it provides in winter and summer, and its native occupant, the Eskimo.

The author presents an intimate view of the Eskimo and his family, his customs, and way of life, as well as an insight to his philosophy, which is as simple and real as the barren wilderness in which he lives. The author conveys some of the fatalistic attitudes of the Eskimo throughout his theme. Hardships, inconveniences, actual dangers are presented in a modest, straightforward manner that belies and underplays the courage and resourcefulness of the individuals concerned. The overtone throughout the book is one of absolute confidence that man can exist in the Arctic if he understands it and works with it as the Eskimo does; that is, with an acceptance of the problems as they are, and the resolution to do what is possible as the opportunity occurs. This understanding of the immediacy of problems in the Arctic was underlined by the author when he said that you must ". . . make up your mind. Don't stand on one foot; do whatever you think best, but do it."

This book should be read by those who seek to understand the role of the airplane and the men who flew them in the exploration of the Arctic. It cannot be read without gaining a greater appreciation for the airmen who pioneered these routes, the courage and resourcefulness that they displayed, and the confidence that they had in themselves and the machines that they flew.

GORDON E. HEIN
Colonel, USAF

SPACE BIOLOGY: THE HUMAN FACTORS IN SPACE FLIGHT, by James S. Hanrahan and David Bushnell: Basic Books, Inc., New York, 1960, $6.00.

Numerous books have been written on the subject of space flight but few of them have considered in any detail the human factors involved in sending a man into space. The present book, written by two historians of the Air Force Missile Development Center at Holloman Air Force Base, has done an excellent job in filling this void.

Though not trained in the sciences, the authors have, nevertheless, been able to capture the excitement of research in the fast-developing science of space biology, and have successfully portrayed both the scope and historical background of this new science.

In addition to reviewing the highlights of our present understanding of the biological problems of space flight and the experiments conducted to obtain this knowledge, they have tried to point out the individual civilian and military scientists, both here and abroad, who have been responsible for progress in the field of space biology.

Of the five parts to the book, Part I is the shortest, consisting of but a single introductory chapter in which the authors trace the desire of man to escape the confines of the earth from antiquity to the present day.

Part II entitled "The Space Vehicle" discusses the problems of creating and maintaining an artificial environment aboard the space ship—one having the proper atmos-

pheric composition and pressure, temperature, and humidity; shows how this information was obtained through studies of Peruvian natives in the Andes, of mountain climbers in the Himalayas, of submarine voyages, and of early balloon flights; and describes the possible effects of a sudden loss of cabin pressure on the space occupant. The three methods proposed for controlling the cabin atmosphere (chemical, mechanical, and biological) are discussed as well as suggested schemes for providing the space traveler with adequate food and water, and disposal of his wastes. Of perhaps special interest to the reader are those experiments described on the use of algae for replenishing the oxygen supply of the space vehicle, in removing carbon dioxide from the air, in providing food for long-term voyages, and in recycling human wastes.

Part III entitled "G-Forces and Weightlessness" makes up the bulk of the book. In addition to discussing the problems of acceleration, deceleration, low and high g-forces, and weightlessness, the authors vividly describe the numerous experiments carried out with man and lower animals on the centrifuge and rocket sleds, as well as with actual rockets and aircraft. Valuable information is also given on such topics as: the problems of takeoff, re-entry, and impact; the relationship of body position to g-forces; various protective techniques against g-forces from water-filled space suits and immersion in a water-filled capsule to inclosure in a rigid envelope and "multi-directional" positioning; the sensations, effects, and countermeasures of weightlessness; and the untimely suspension of animal experiments during the austerity drive of 1957.

Part IV entitled "The Radiation Hazards" briefly describes research being carried out on the effects of various types of radiation including cosmic rays, ultra-violet rays, the recently discovered high-intensity radiation of the Van Allen belts, and the radio microwaves.

The concluding chapter of the book, comprising Part V, considers the present and future impact of astronautics on religion, education, government, politics, economy, music, art, and literature.

Except for minor errors (e.g. calling the alga *Chlorella* a variety instead of a genus, and implying that algae are all single-celled plants) the book is well written and should be easily comprehended by the layman as well as the more advanced student of astronautics. There is little question but that it is the best book of its kind published thus far. The fact that the authors have carefully documented their statements with nearly 40 pages of citations should make the book even more valuable.

DONALD T. KRIZEK
1st Lieutenant, USAF
Research Studies Institute

WIND ON MY WINGS, by Percy Knauth: Doubleday & Company, New York, 1960, $3.95.

Generally, the thrill of learning to fly receives little attention as a human experience except among other flyers. Accounts of the excitement, awesome moments of fear and anxiety, and the full satisfaction for accomplishment in becoming adept at air pilotage appear to have lost general conversation appeal. Despite this seeming lack of interest by the general public, each year new thousands of men and women are taking to the air as pilots.

Mr. Percy Knauth, a former reporter and war correspondent, ably portrays an intimate, exciting account of how he learned to fly. He graciously beckons the reader in his book to look over his shoulder to see, hear, feel, and thrill with him to each aspect of mastering the problems of aerial flight well enough to earn a Private Pilot's license.

*Wind on My Wings* is presented in 237 pages, conveniently arranged in 9 Chapters of delightful reading. Mr. Knauth writes in a straightforward, vivid, and never tiresome manner. This book exhibits the craftsmanship that has gained acceptance for his numerous stories and articles in some of the country's leading magazines.

Mr. Knauth's book is recommended reading for all young men and women of any age who will one day want to become pilots in their own right. To all others, Mr. Knauth's story of his experiences, including a 24-hour Atlantic crossing in a light plane, well serve to accurately approximate learning to fly via the written word.

JOHN A. McCANN
Colonel, USAF

# RECENT BOOKS

*Airview*, (Editor), *German Military Aircraft in the Second World War*. Tokyo: Kantosha, 1950. 2 vols. The first volume, in Japanese, gives photos and drawings; the second, in English, is minus the illustrations.

BRIAND, PAUL L., *Daughter of the Sky: The Story of Amelia Earhart*. New York: Duell, Sloan and Pearce, 1960. $3.95. Readable and scholarly account of her flying activities and the historic "firsts" which led up to her disappearance in June 1937.

BROPHY, ARNOLD, *Sky Sentry; A SAC Crewman in Service*. New York: Dodd, 1960. $2.75. A narrative-photo history of the Strategic Air Command.

CARHAM, EDWIN D., *Man's Great Future*. New York: Longmans, Green, 1959. $4.00. A condensation from The Christian Science Monitor's anniversary issue, which outlines the problems that face us in this modern age and ways in which democratic society can maintain its character while meeting the challenges of materialism, communism, the space era and others.

CHESSMAN, E. F., Editor, *Fighter Aircraft of the 1914-1918 War*. Herts, Eng. Harleyford; Letchworth, 1960. $8.50. Illustrated, exhaustive account, historically and technically accurate.

CRANKSHAW, EDWARD, *Krushchev's Russia*. Baltimore: Penguin Books, 1960. .85 (paper). Concise and clearly written by a noted British observer of Soviet affairs. He sees Krushchev as a man of immense drive and cunning but the author belittles the basic force of communism.

DEUTSCHER, ISAAC, *The Great Contest*. New York: Oxford University Press, 1960. $2.75. In 1953 the author predicted with amazing accuracy the outlines of the struggle between the Malenkov and Krushchev lines. In this volume he again applies his background and knowledge of Russian affairs to the task of forecasting Russia's future.

DORNBUSCH, CHARLES EMIL, *Unit Histories of the U. S. Air Force, Including Privately Printed Personal Narratives*. Hampton Bays, N. Y.: Hampton Books. 1958.

GINZBERG, ELI AND OTHERS, *Ineffective Soldiers, Lessons in Management and the Nation*. New York: Columbia University Press, 1960. 3 vols. $6.00 each. A study of men who were rejected or separated from military service because of emotional or mental defects. One of best studies available on the strength and weaknesses of men. "One of the most significant findings was that many of the men who broke down did not do so through inherent weakness but because of poor leadership and poor basic policy."

GLINES, C. V. and MOSELEY, W. F., *Grand Old Lady; Story of the DC-3*. Cleveland, Pennington Press, 1960. $3.95. A collection of affectionate anecdotes about the "Methuselah of the Skies" by two experienced C-47 pilots.

HUSZAR, GEORGE B. de, *National Strategy in an Age of Revolutions*. New York: Praeger, 1959. $6.00. A collection of addresses at the National Military-Industrial Conference, 1958, by such people as Dr. Strausz-Hupé, Major de Seversky, Dr. Trylten, Dean Weidner, Dr. Von Braun, and Dr. Robert Johnson.

LA CROIX, R. de, *They Flew the Atlantic*. Translated from the French by Edward Fitzgerald. New York: Norton, 1960. $3.95. A record of flying pioneers who challenged the Atlantic Ocean from 1910-1934. Short and simply written.

LIDDELL HART, B. H., *Deterrent or Defense*. New York: Praeger, 1960. $4.95. Defense against nuclear attack is so inadequate that World War III must result in losses entirely unacceptable to any sane government, so we must still depend on defense with conventional weapons.

MIGEO, MARCEL, *Saint-Exupery*. New York: McGraw-Hill, 1960. $5.95. Biog-

raphy of a famous air pioneer, the French flyer-writer who died in a P-38 crash during World War II.

MITCHELL, BRIG. GEN. WILLIAM, *Memoirs of World War I.* New York: Random House, 1960. $4.95. An eyewitness account by the only high ranking American officer at the front immediately after we declared war.

ROBERTS, LESLIE, *There Shall Be Wings.* Toronto: Clarke, Irwin, 1959. A history of the Royal Canadian Air Force.

ROSTOW, W. W., *The United States in Recent History.* New York: Harper, 1960. $8.75. His narrative of how strategy and policy of World War II unfolded and their underlying forces is fascinating. Also gives brilliant account of the beginnings of the present Administration.

SALISBURY, HARRISON E., *Has Krushchev Changed Communism?* New York: Harper, 1950. $4.95. The author accepts at face value Krushchev's search for "peaceful coexistence" and appears to regard him as a moderate.

STANTON, PAUL, *Village of Stars.* New York: Morrow, 1960. $3.95. A novel which describes the adventures of a British Bomber, flying over the Middle East, unable to unload a nuclear bomb with which it is armed, unable to defuse it, and unable to land.

TAYLOR, JOHN W. R., *Russian Aircraft.* London: Ian Allan, 1960. 2s6d. Complete photographic and statistical guide to Soviet military and civilian aircraft.

TAYLOR, JOHN W. R., *Warplanes of the World.* Surrey, Eng. Ian Allan, 1960. 10s6d. 238 planes in use today throughout the world.

WAYS, MAX, *Beyond Survival.* New York: Harper, 1950. $4.00. A senior editor of *Time Magazine* feels that society puts unnecessary faith in the idea that only the world of science is real, while the world of abstract ideas, such as freedom and justice, is meaningless.

KENNEDY, JOHN F., *The Strategy of Peace.* New York: Harper, 1960. $3.50. A collection of foreign policy speeches and statements on matters of national security and other global issues.

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## EXCERPTS FROM UNITED STATES STRATEGIC BOMBING SURVEY (Pacific War)

*Page 28:* ". . . For the future it is important fully to grasp the fact that enemy planes enjoying control of the sky over one's head can be as disastrous to one's country as its occupation by physical invasion."

*Page 26:* " . . . air supremacy over Japan could have exerted sufficient pressure to bring about unconditional surrender and obviate the need for invasion."

*Page 21:* ". . . surrender had become unavoidable; the Army, even should it repel invasion, could no longer protect the Japanese people from extermination."

*Page 27:* "1. Control of the air was essential to the success of every major military operation. . . ."

These statements need only to be phrased in generic terms in order to establish the sound strategic conceptions which must be adopted.

# RECENT ARTICLES

ANDREWS, PAUL S., "Blueprint for a Peaceful World," *Current History*, Vol. 39, August 1960, pp 75-81. A plan for disarmament under world law plus a mutual development plan.

AURAND, H. S., JR., "The Balance of Terror: The U. S. and the Soviet Union," *Vital Speeches*, Vol. 26, July 1, 1960, pp 549-552. We must bend every immediate effort to stabilize the situation by the correct choice of weapons and forces.

BETHE, HANS A., "The Case for Ending Nuclear Tests," *Atlantic Monthly*, Vol. 205, August 1960, pp 43-51. Before long, he believes world opinion will force us to stop testing without our getting anything in exchange, where there are some advantages to accepting a less than perfect agreement now.

BLAIR, C., JR., "Uncle Sam's Orphan Airlines (MATS)." *Saturday Evening Post*, Vol. 232, June 4, 1960, pp 31-32.

CAHN, ROBERT, "Behind the First A-Bomb," *Saturday Evening Post*, Vol. 233, July 16, 1960, pp 16-72. An account of the activities of the week of July 10-15, 1945.

COUSINS, NORMAN, "CBR vs. Man," *Saturday Review*, Vol. 43, July 23, 1960, pp 9-12. Concludes that "the crisis of man in today's world is not primarily that of competing ideologies but power without control . . ."

FEIS, HERBERT, "The Secret that Traveled to Potsdam," *Foreign Affairs*, Vol. 38, January 1960, pp 300-317. The atomic bomb.

GALLOIS, GEN. P. M., "Missile Carrying Aircraft," *Interavia*, Vol. 15, July 1960, pp 808-813.

HALLER, DR. G. L., "A Study for Survival," *Vital Speeches*, Vol. 26, September 15, 1960, pp 708-712. "The pilot in his cockpit, the missileman in his blockhouse, the soldier in his foxhole, now all rely heavily on the scientist in his laboratory. The defense of the Nation rests on how well we can mold all of these people into a team."

HOWARD, MICHAEL, "Civil-Military Relations in Great Britain and the United States," *Political Science Quarterly*, Vol. 75, March 1960, pp 35-64.

HUDSON, G. F., "United Nations Emergency Force: A Notable Precedent," *Current History*, Vol. 38, June 1960, pp 326-331.

KISSINGER, HENRY A., "Arms Control, Inspection and Surprise Attack," *Foreign Affairs*, Vol. 38, July 1960, pp 557-575. An arms race is the most unstable of all forms of security; properly conceived arms conrol may increase security.

KLASS, P. J., "USAF Shows Orbital Bomber Cockpit," *Aviation Week*, Vol. 73, August 8, 1960, pp 32-34.

MEDARIS, MAJ. GEN. JOHN B., "How to Rescue Our Defense Effort," *Look*, Vol. 24, September 27, 1960, pp 17-21. Among other things, he advocates a single chief of staff and a recombined Army and Air Force.

MORGENTHAU, H. J., "The Crisis of American Policy," *Vital Speeches*, Vol. 26, July 1, 1960, pp 559-563. Perhaps of all the reforms which could be suggested for the renovation of American foreign policy, none is more important than the rediscovery of the purpose of America.

PENDRAY, G. EDWARD, "The Man Who Ushered in the Space Age; Dr. Robert H. Goddard," *American Legion Magazine*, Vol. 69, September 1960, pp 10-11.

TAYLOR, JOHN W. R., "Bomber Command's Missile Force," *Air Power*, Vol. 7, Summer 1960, pp 265-272. The program where the Thor was deployed in the U.K.

"A-Power: Things to Come," *Newsweek*, Vol. 56, September 19, 1960, pp 69-72. Special space and atom report.

"Air Force Almanac 1960," *Air Force*, Vol. 43, September 1960. Special issue on U.S. Air Force commands and highlights of the year.

"Communist China and the Arab-Africa Area." Lt. I. W. Zartman, *U.S. Naval Institute Proceedings*, 86:23-30, Sept '60.

NATO and Free World Security, *Current History*, Vol. 39, entire issue, September 1960.

"Soviet Ideas on Nuclear Strategy," *Interavia*, Vol. 15, July 1960, pp 819-820.

"World Missile/Space Encyclopedia 1960," *Missiles and Rockets*, Vol. 7, July 18, 1960, E Section. Gives basic data on each type of missile.

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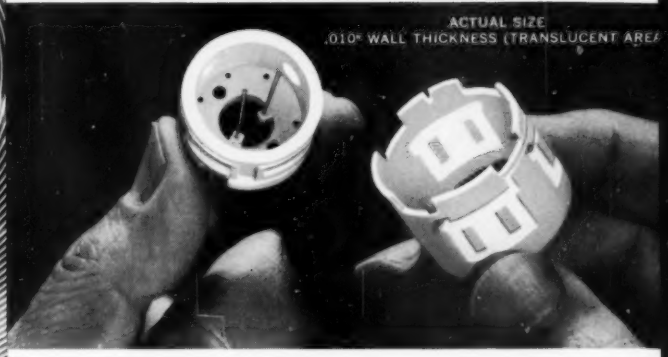


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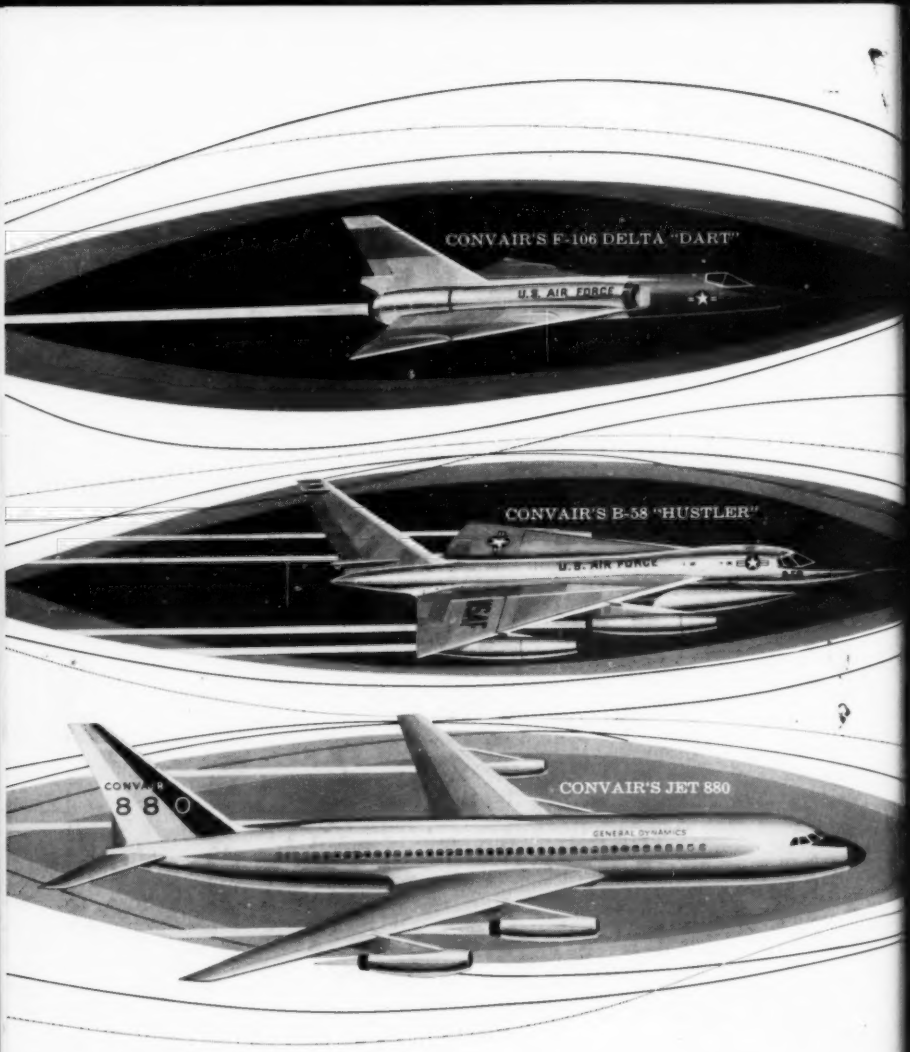


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